VOL. 26, No. 7 JULY, 1949

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Published Monthly by the AMERICAN JOURNAL OF OPTOMETRY PUBLISHING ASSOCIATION,
1502 Foshay Tower, 821 Marquette Ave., Minneapolis 2, Minn.

ANNUAL SUBSCRIPTION $5.00 CANADA $5.50, FOREIGN $6.00
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Publication Office: 1502 Foshay Tower, 821 Marquette Ave., Minneapolis 2, Minn.

AMERICAN JOURNAL OF OPTOMETRY *and* ARCHIVES *of* AMERICAN ACADEMY OF OPTOMETRY

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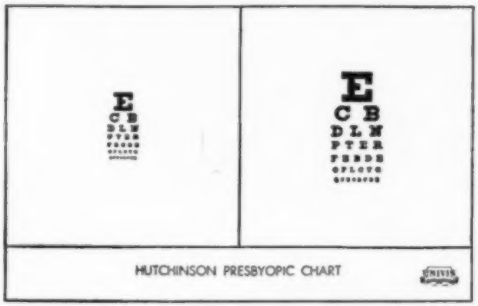

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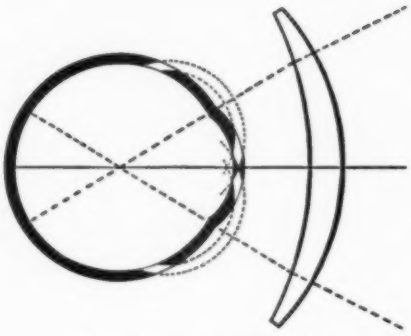

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Vol. 26 JULY, 1949 No. 7

AN OBJECTIVE HIGH SPEED PHOTOGRAPHIC TECHNIQUE FOR SIMULTANEOUSLY RECORDING CHANGES IN ACCOMMODATION AND CONVERGENCE*

Merrill J. Allen†
School of Optometry, The Ohio State University
Columbus, Ohio

I. PROBLEM

The basic problem to be solved by the equipment about to be described is the time relationship of the accommodation response and the accommodative convergence associated with it when one eye is covered and the target seen by the other eye is instantly changed from far to near or from near to far.

The recording of convergence is done by a modified American Optical Company ophthalmograph to be described later. The recording of accommodation is accomplished by photographically recording the size of the Purkinje image of a bright object formed by the front surface of the human lens.

To record this image successfully on film at a motion picture speed of 64 frames per second, it was necessary to solve the following problems:

a. The image produced by reflection at the front surface of the lens of the human eye is usually of poor quality, giving somewhat the appearance of an image from an orange peel.
b. The brightness of this image is so low that it is difficult to record with short photographic exposures.
c. The eye must be guarded against excessive concentrations of light and heat energy.

The first two problems were solved by using a sensitive film and a bright object consisting of two squares of appreciable angular size.

*Submitted on March 23, 1949, for publication in the July, 1949, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.
†Optometrist. American Optical Company Research Fellow in Physiological Optics.

It will be recalled that the image of a point produced by an irregular reflecting surface is a blur circle and not a point, and that an object of finite size effectively consisting of a number of points will, by virtue of the overlapping of the blurred images, produce a summated image with a higher brightness at its center than could be obtained with a single point source.

The bright object referred to above is the aerial image of two bare filaments (32-32 c.p. automobile headlight bulb) and its position is approximately 15 mm. in front of the cornea.

Since the images of the two filaments are formed at approximately the anterior focal plane of the eye, the blurred image of each filament formed on the retina is about as large as the pupil of the eye, and since no actual focusing of the rays can occur within the media of the eye under these conditions, no undue concentration of energy can exist at any point within the eye.

The techniques described in this paper have been used in a study of the time relation between accommodation and convergence. The complete data from this study will be published at a later date. However, a pair of simultaneous records of changes in accommodation and convergence is included in this paper to give an idea of the type of data that can be obtained.

The photographic method of recording accommodation used for this research is similar in principle to that used by Kirchhof[1] to objectively measure the speed of accommodation. The major difference between the two methods is that Kirchhof used a continuous exposure and a continuously moving film, while in the present study the exposure and the movement of the film were both intermittent.

II. EQUIPMENT

a. Haploscope and Targets

The basic unit of the equipment is a haploscope which has two arms that rotate around separate vertical axes which are made to pass through the centers of rotation of the two eyes. The left eye is effectively occluded during all phases of the experiment except that of calibrating the convergence record, but this occlusion does not interfere with the photographic recording of the convergence of the two eyes.

The targets controlling fixation and accommodation are presented to the right eye. To be able to switch easily and instantly from one accommodative target to another, a telecentric optical system and a battery of partial mirrors is used. Figure 1 gives the essential optical layout and constants involved. Two shutters not shown in the figure are placed just beneath the frosted glasses and lie in the plane of the

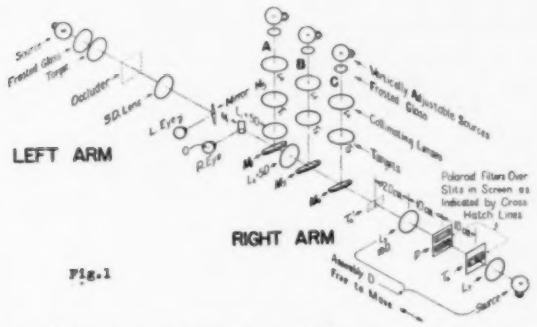

Fig. 1. Optical systems for the right and left arms of the haploscope. Shutters not shown in the figure are placed between the frosted glasses and the collimating lenses and permit only one of the vertically adjustable targets T_1 T_2, or T_3 to be exposed at a time. M_2, M_3 and M_4 are partial mirrors. Assembly D is an auxiliary system used for precise determination of the refractive state of the eye. The occluder in the system for the left eye is removed only during calibration of the convergence record.

images of the entrance pupil of the right eye of the observer. These images are formed by lenses L_1 and L_4, L_2 and L_5, and L_3 and L_6. The shutters are so arranged that the first shutter can occlude beam A or beam B, and the second shutter can occlude beam C or beam B. Each shutter is controlled electrically and has a negligible operating time (less than one one-thousandth of a second). By using different shutter blades

Fig. 2. The target pattern employed for controlling accommodation and fixation. The inside diameter of the smallest ring subtends five minutes at the eye and the outside diameter of the largest ring subtends nine degrees at the eye. There are two small concentric rings at the center of this pattern which may be difficult to discriminate from a single disk.

Fig. 3. Appearance of the target T_4' when it is and is not conjugate to the retina.

and by actuating one or the other of the two shutters, sequences of accommodative stimuli may be obtained such as follows: zero to two; zero to four; two to zero; four to zero diopters.

The battery of mirrors shown in Figure 1 can combine the three separate beams A, B, and C into one common beam which would then enter an eye placed at O. However, only one beam at a time is permitted by the shutters to reach the subject. Paths A, B and C each contain identical photographic targets as shown in Figure 2. In path A the target may be moved through a stimulus range of O to 5D., in path B the stimulus range is O to 3D., while in path C it is only O to 2D.

By virtue of the telecentric optical system (the secondary principal foci of lenses L_1, and L_2 fall at the center of the entrance pupil of the eye) changes in position of the targets cause no variation in their angular size, and furthermore, dioptric changes are represented by a linear scale; in this case 1.00 D. = 4 cm. Dioptric values are defined in terms of the reciprocal of the distance from the entrance pupil of the eye.

b. Accommodation Calibrating Device

Assembly D of Figure 1 represents the accommodation measuring device, which is similar in principle to the devices which have been employed by Fry[2, 3] for the same purpose. The two slits at P are projected into the plane of the entrance pupil of the eye by lenses L_2 and L_3, and are 2 mm. apart in that plane and each has a width of ½ mm. An aerial image T_4' of T_4 is produced by L_3. This aerial image of T_4 serves as the target. Polaroid filters cover the slits at P and the two halves of the slit at T_4 with the axis of polarization oriented as indicated by the cross hatched lines.

T_4' moves along with assembly D and always lies at a fixed distance from L_3. This device is used as a null indicator of the amount of accommodation in play by moving the whole assembly D along the optic axis of the system until the two parts of T_4' are seen by the subject as aligned. When this condition is achieved T_4' lies at the conjugate focus of the retina. One can use the position of the system as read on a precalibrated scale to indicate the amount of accommodation in play. See Figure 3.

c. Convergence Recording Device

The American Optical Company ophthalmograph designed for recording eye movements during reading was modified by changing the gear drive to the film and by adding a shutter and a neon time marking device. The latter will be described under subdivision e. The film speed was increased from ½ inch per second to 1 inch per second. A 30° rotary type electromagnet was mounted outside the film chamber

and its shaft was extended into the chamber. A shutter swinging just in front of the film was attached to this shaft (see Figure 4). Small spring clips were attached to the adjustable lens tubes of the instrument to ensure that the adjustments of focus and alignment would not change during the experiment.

The ophthalmograph uses light reflected from the cornea to track the position of the eyes. Normally two automobile 32 c.p. bulbs are employed, one for each eye, placed about 15° below and to the outside of each line of sight. However, in this experiment a common source was placed in the median sagittal plane of the subject, 2½ inches below the level of his eyes and about 6 inches from the root of his nose. This source is a 2.5 volt flash light bulb. The general arrangement of the

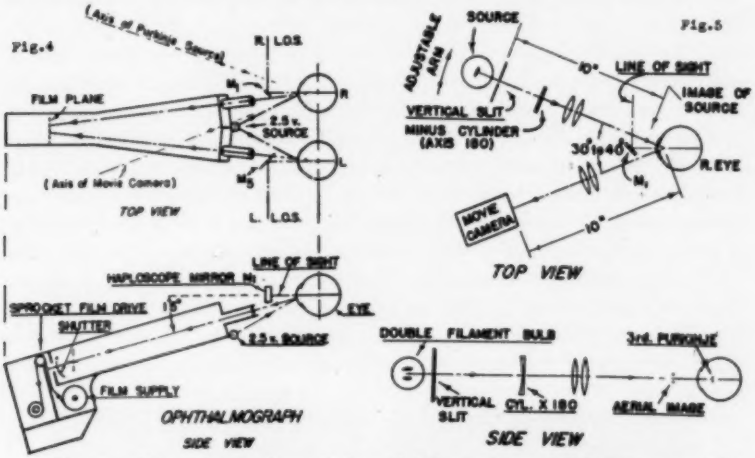

Fig. 4. Side and top views of the ophthalmograph and light source used for recording convergence. The relationship between the ophthalmograph and the haploscope mirrors is shown. The axes of the Purkinje source and of the movie camera are shown in the top view.

Fig. 5. Optical system for producing and photographing the third Purkinje image.

light source, the ophthalmograph and the haploscope mirror before the right eye can be seen in Figure 4. The haploscope mirrors, M_2 before the right eye and M_3 before the left eye (see Figure 1 as well as Figure 4) do not interfere with the photographic recording of the corneal images of the 2.5 volt light source.

d. Accommodative Recording Device

The camera used to record accommodation is the G. S. A. P. (Gun

Sight Aiming Point) 16 mm. electric movie camera manufactured by the Fairchild Aviation Corporation. It is equipped with a magnetic frame marker, three running speeds, 16, 32 and 64 frames per second, and a governor controlled 12 volt D.C. motor. In addition it is a magazine load camera which gives it all the features required for this application.

Figure 5 shows a sketch of the top view of the movie camera and light source. The light source and the optic axis of the camera lie in a horizontal plane passing through the center of the pupil of the right eye. The camera utilizes two 5 inch focus objectives turned toward each other to make a symmetrical system of unit magnification and relative aperture of f/1.8. With this arrangement the camera body is located 10 inches back from the eye which gives sufficient room for both the ophthalmograph and the movie camera.

As seen in Figure 5, two 5 inch focus lenses of the same type as used on the camera are turned toward one another to form a projecting system arranged to give a magnification of one-half. Since the automobile headlight bulb used has a pair of horizontal filaments of appreciable length compared to their width, the Purkinje image obtained from the bare filaments would be a pair of oval shaped blur circles. To obtain circular blur circles and also to reduce the light reaching the retina, a vertical slit of width equal to the coil width of the filament was placed adjacent to the bulb. In order to bring the filaments to the plane of the slit a —0.75 D. cylinder axis 180° was located between the slit and the main lenses. The image produced by this system is a pair of squares .25 mm. on the side and of 1.8 mm. vertical separa-

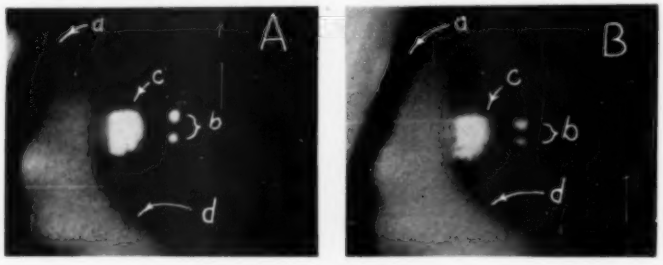

Fig. 6. Photographs of the third Purkinje image showing change in size associated with accommodation. Accommodative stimulus: A. 0.50 D.: B. 4.00 D. Parts of the photograph are: a. shadow of frame marker, b. third Purkinje image of the pair of bright squares, c. corneal reflex, d. margin of pupil. Slight changes in fixation of the right eye do not interfere with the photographing of the third Purkinje image.

tion between centers. Each square has a candlepower of about 3.5 candles in the direction of the pupil.

The mirror M_1 used by the right eye for viewing the targets does not interfere with the photographic recording of the third Purkinje image (see Figure 5).

The motion picture camera is equipped with a small electro-magnet to which is attached a thin wire pointer. The end of this pointer lies just in front of and parallel to the film plane and casts a shadow on the film (see Figure 6). The electromagnet is controlled by means of a switch on the mechanical timer and is energized at the moment when the stimulus to accommodation is changed and again after a one second interval. To ensure adequate light to record the pointer, the camera is usually adjusted so that the corneal reflex falls on the end of the pointer.

e. Timing Devices

1. Mechanical

To control a number of separate operations, i.e. to change targets, start and stop camera, mark films, give "fore signal," and furnish a fairly good timing device, a mechanical timer was built. The power source is a 1 revolution per second geared Bodine motor. It drives one shaft directly at 1 r.p.s. and by reduction, drives the second shaft at 1/10 r.p.s. This device is fairly accurate, losing about 1/60th of a second per revolution, hence it is necessary to have an auxiliary time scale on the ophthalmograph film and on the movie film.

The low speed shaft (1 revolution every 10 seconds) carries 4 cam wheels which operate micro-switches to perform the following operations: give "fore signal," start movie camera, start ophthalmograph, select proper revolution for operation of switches on the high speed shaft, stop movie camera, stop ophthalmograph, stop timer itself.

The high speed shaft (1 revolution every second) carries three cam wheels which operate micro-switches to control (1) the exact moment of change of stimulus, (2) the shutter for marking the moment of this change on the ophthalmograph film, (3) the momentary interruption of current to the neon lamp in the ophthalmograph and (4) the magnetic movie frame marker.

2. Neon Light

The ophthalmograph record is time modulated by using a neon source operating on ½ wave rectified 60 cycle current and an optical system which focuses the light on the margin of the moving film. This produces a set of lines on the film separated by 1/60th of an inch.

To obtain an equivalent record on the movie film, it is only neces-

sary to photograph a neon source directly, the source being photographed with the aid of a small mirror in front of the camera lens. Since the camera runs at some speed near 64 frames per second, and since on alternating current the two poles in a neon source glow alternately, each pole flashing 60 times per second, a beat frequency of 4 per second will occur between the camera shutter and a single pole of the neon source. Hence, if the camera is running at 64 frames per second, every 16 pictures will constitute a beat cycle, the neon source being either not photographed or photographed depending on where the camera shutter is when the neon tube flashes.

III. PROCEDURE

A biting board is prepared for the subject who is then aligned in the haploscope by means of the biting board and a forehead rest so that the optic axis of the right arm enters the center of the pupil of his right eye, and so that the centers of rotation of his eyes are at the centers of swing for the haploscope arms.

The convergence calibration is obtained by removing the occluder (see Figure 1) and thus giving the subject a fusion target for the left eye similar to the target on the right side and varying the position of the left haploscope arm to various convergence values up to, normally about 15°, taking a photographic convergence record of the corneal reflex at each convergence value. The occluder is then replaced and the target for the left eye is kept occluded for the remainder of the operations.

The accommodation calibration is conducted by determining the exact amount of accommodation with the accommodative measuring device at various levels of accommodative stimulation, and photographing the corresponding size of the Purkinje image.

Following the alignment and calibration operations, the shutter mechanism is adjusted for a specific accommodative stimulus change and the subject is given several practice cycles, and then two cycles with the cameras recording his convergence and accommodation.

A typical cycle is 10 seconds long and contains the following stages:

1. The manual switch is pushed to start the timer.
2. At 3.0 seconds a tactual "fore signal" is given the subject.
3. At 4.6 seconds the movie camera starts (this is 0.4 second early to avoid confusing the subject. A duplicate empty camera runs continuously to partially accustom the subject to the sound of the running cameras).
4. At 4.8 seconds the ophthalmograph silently starts recording convergence.

At 5.0 seconds the target stimulus shutter is changed giving the subject a change in accommodative stimulus either towards greater accommodation or relaxation of accommodation. Also at 5.0 seconds, the neon time record in the ophthalmograph is interrupted momentarily, the ophthalmograph shutter momentarily interrupts the convergence traces and the magnetic marker in the movie camera marks the "zero" frame.

6. At 6.0 seconds the neon time record in the ophthalmograph is again interrupted, and simultaneously the magnetic marker in the movie camera marks the one second frame.
7. At 6.8 seconds the ophthalmograph motor is stopped, the movie camera motor is stopped, and the accommodative stimulus shutter is returned to its starting position.
8. At 9.5 seconds the timer motor itself is automatically turned off and the cycle is complete.

Practice cycles are conducted exactly the same as a recording cycle except that the ophthalmograph is turned off and the movie camera frame speed selector is shifted into a neutral gear position disengaging the motor from the shutter and film drives. Since the ophthalmograph motor is practically silent it does not alter the practice cycle by being turned off. The movie camera on the other hand must be permitted to run at the proper moment to acquaint the subject with the loud noise and sudden onset of the noise. By shifting the frame speed selector to a neutral position the primary sound characteristics of the camera are retained but no film is used.

The amount of 35 mm. convergence film used per cycle is about 2¼ inches. The amount of 16 mm. Purkinje image film used per cycle is about 5 feet. The types of film used are: 35 mm., Weston 100-64, panchromatic; 16 mm., Weston 64-40, panchromatic film, mercury hypersensitized to approximately Weston 100.

IV. SAMPLES OF RECORDS OBTAINED

a. Accommodative

Figure 6 is a positive print from the actual photographs of the third Purkinje image as obtained from the calibration data of subject T.

b. Convergence

Figure 7 is an ink tracing of the enlarged convergence record of subject H.A.K. A greater separation of the lines indicates a greater convergence of the eyes.

V. METHOD OF TREATMENT OF DATA

To facilitate handling the convergence data, photographic enlarge-

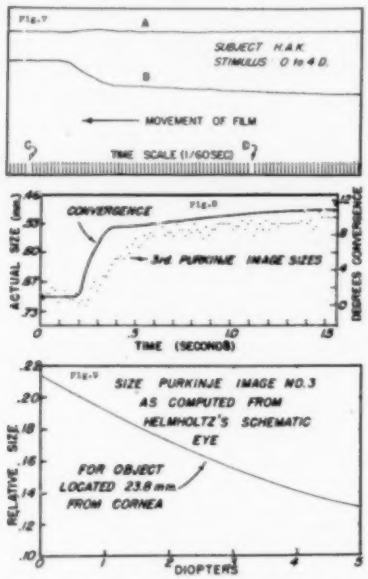

Fig. 7. Trace of photographic record of convergence obtained with the ophthalmograph. A is the record produced by the corneal reflex of the right eye. B is that of the left eye. The lines at the bottom of the record are produced by the flashing neon source and are separated by 1/60th of a second of time. The breaks in records A and B are made simultaneously with the change in the accommodative stimulus, and the corresponding moment is indicated at C by a partial interruption of the neon record. The partial interruption at D marks the end of one second as determined by the mechanical timer. The separation of lines A and B provides the measure of convergence.

Fig. 8. Data obtained from subject H.A.K. for a change from a zero to a four diopter accommodative stimulus. The points represent the Purkinje image sizes measured in successive frames occurring at the rate of 64 per second. The variability from point to point arises principally from errors made in measuring the size of the Purkinje image.

Fig. 9. Size of the third Purkinje image as computed for various dioptric values of accommodation using Helmholtz's schematic eye and by assuming that the entire accommodative change occurs at the front surface of the lens.

ments are made which, with the help of the calibration data, are transformed into a final plot (see Figure 8) adjusted so that the convergence response has the same amplitude as the accommodation response. Adjusting of the amplitude is done to make easy the comparison of the time characteristics of the two responses.

To analyze the accommodative data, each frame is projected using a microfilm reader of 15X magnification and the third Purkinje image size is measured. To prevent magnification errors no focusing during a

series of readings is permitted and the film is mounted in a special slide which forces it flat against a fixed glass surface.

The relative Purkinje image size is read using a modified vernier caliper and low contrast lines for estimating the centers of the blurred spots produced by photographing these images. As discussed earlier these images are inherently blur circles, and even using a parallax technique for determining the goodness of camera focus, the photographic images obtained are blurred spots.

Once measured, the actual sizes of the Purkinje images are plotted directly as indicated in Figure 8. However, by means of the accommodation calibration data the Purkinje image data can be replotted in terms of accommodation. Figure 9 gives the theoretical relationship between the size of the third Purkinje image and accommodation as computed from Helmholtz's schematic eye[4] and an object distance of 23.8 mm. on the assumption that accommodation is produced by changes in curvature of the front surface of the lens. The relative size in this case means the ratio of the image size to the object size.

VI. SUMMARY

A method, apparatus and procedure have been presented for objectively measuring accommodation and convergence simultaneously. Discussion is given to the problem of photographing the Purkinje images at 64 frames per second.

Samples of photographic data are shown together with the method of analysis and a sample plot of the data obtained.*

*The author takes this opportunity to thank the American Optical Company for the Fellowship which has helped make this study possible, and to thank Dr. Glenn A. Fry for his assistance, council and inspiration.

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HIGH MYOPIA AND VERTICAL PHORIA CORRECTED WITH CONTACT LENSES—A CASE REPORT*

Norman Bier†
London, England

Patient, A. W. J., male. Occupation, valet and private secretary. Age 31.

SIGNS AND SYMPTOMS

Patient would like to be fitted with contact lenses primarily because spectacles are disliked as they are so very heavy and thick. He is satisfied with present visual acuity but would appreciate better vision if this is possible. He experiences no diplopia normally, but does so at times when eyes tire, and after undue ocular effort. He has rare headaches and occasional mild asthenopia. Reduced field of vision is a great disadvantage for the patient. He can see much better in bright light. He reports that neither his distance nor near vision have ever been good.

HISTORY

Myopic since the age of five. No family history. Patient has had most of children's illnesses and was never strong as a child. Often was ill and run down. Rheumatic fever a few years ago. He has had his eyes examined every 12 months. Patient has been told in the last few refractions that his myopia is now stationary. He reports having had jaundice three years ago, but no accidents or surgery.

GENERAL HEALTH

Patient not very strong and reports that he catches cold easily. He smokes about 30 cigarettes daily.

VISUAL HABITS

The patient reads scripts nearly every day for one to two hours. Apart from general house work and private correspondence the patient uses his eyes as little as possible. He goes to the theater frequently but rarely to the cinema.

PRESENT PRESCRIPTION

O.D. —21.00 D.sph. ⊂ —0.75 D.cyl.axis 90.
decentered to produce 3½ prism diopters base-down.

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*Submitted as portion of the entrance requirements of the American Academy of Optometry. Approved by the Examining Board. For publication in the July, 1949, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

†Optometrist. Fellow, American Academy of Optometry. Fellow, British Optical Association. (Hons.).

O.S. —19.00 D.sph. ⌒ —2.00 D.cyl.axis 20.
decentered to produce 3½ prism diopters base-up.
This correction, which was obtained five months ago, was made up in Crooks A1 absorption glass. Flat form of lenses. Corrected visual acuity was O.D. 6/24 plus 1. O.S. 6/24. O.U. 6/24 plus 1.

SURGEON'S REPORT

An ophthalmic surgeon's opinion was sought before fitting contact lenses in view of the fundus picture and the high degree of the ametropia. His report follows: "Today the refraction of Mr. A. W. J. is quite as it was three years ago and contact lenses would be appreciated . . . ."

DATA SPECIALLY IMPORTANT FOR CONTACT LENS WEAR

No undue colds of late. No chronic catarrh or hay fever. No epiphora or conjunctivitis. No styes. No allergy. Oily skin. No undue photophobia or other ocular irritations which would contra-indicate this type of correction.

PRELIMINARY EXAMINATION

Unaided visual acuity: O. D. less 6/60 at ½ meter. O. S. less 6/60 at ½ meter.

Versions and rotations: Normal considering the degree of myopia. Elongated eyeballs causing due restrictions on rotations.

Near point of convergence: 14 cm.

Intra-ocular pressure: Normal, O. D. and O. S.

External examination: Lid margins clean, conjunctiva clear, slight exophthalmos O. U. Lid pressure a little plus. Center of the cornea quite clear although arcus senilis in both eyes, more marked in left. Iris margins well defined. Right pupil diameter 5 mm. Left diameter 3 mm. All reactions fully present although sluggish. P. D. 64 mm.

Ophthalmoscopic examination: Media clear, apart from two small central floating vitreous opacities in each eye. Both crystalline lenses seem clear. Typical myopic fundi with myopic degenerations present O. U. Three medium sized pigment patches present in the left eye on the temporal side. Myopic and choroidal crescents nasally. Few vessels present. Crossing and relationship of these normal. Choroid distinctly visible in the superior half of the right eye and in the superior and temporal portions of the left eye.

Transillumination: Gums and teeth appear normal.

ANALYTICAL EXAMINATION

Ophthalmometer: Right corneal radius 8.91 mm. Left corneal

radius 8.72 mm. Both of these radii are the means between major axes of corneal curvature.

Retinoscopy: In this case this proved most difficult and it was not carried out. The ophthalmic surgeon who refracted this case derived his findings as the result of static retinoscopy under cycloplegic. Subjective tests: By using the combination of block and fan and crossed cylinders the folowing prescription was worked out:

O.D. —21.25 D.sph. ⌒ —0.50 D.cyl.axis 90
O.S. —19.00 D.sph. ⌒ —1.75 D.cyl.axis 15

No near point binocular addition required.

Visual acuity with above: O. D. 6/24 plus 1. O. S. 6/24 plus 1. O. U. 6/24 plus 1. Vertex distance (distance from back surface of trial lens to anterior surface of cornea) 14 mm. O. U.

Amplitude of accommodation: O. D., and O. S., each 8 D. Tolerance O. D., and O. S. 1 D. both plus and minus.

Color vision: Normal.

Campimetry and scotometry: Fields normal for white, red and blue. Target on Bjerrum screen 1 M. from patient. For scotometry 1.5 M. Blind spots were slightly enlarged O. U. For perimetry 4 mm. targets were used.

Binocular vision: When corrected with patient's spectacle correction this was well coordinated and fully established.

Muscle balance: When corrected with patient's spectacle correction: Distance 2 Δ esophoria, and 4 Δ right hyperphoria. At near, 3 Δ exophoria, and 4 Δ right hyperphoria. With hand diploscope. — DO, OG.

Ductions: Horizontal, distance: Negative, 5 Δ break, 3 Δ recovery. Positive, 10 Δ blur, 18 Δ break and 15 Δ recovery. At near, Negative, 12 Δ break, 8 Δ recovery. Positive, 16 Δ blur, 21 Δ break and 17 Δ recovery. Vertical, distance and near: 5 Δ to 6 Δ right superduction, 6 Δ left superduction. Again these findings were secured with the patient's spectacle correction in place.

CONTACT LENS SPECIFICATIONS

General: Plastic ground, decentered oval contact lenses, decentered in the optic, with blended reduced prismatic-optic.

Right Eye	Left Eye
12.75 mm. scleral radius.	12.50 mm. scleral radius.
8.50 mm. corneal radius.	8.50 mm. corneal radius.
12.50 mm. corneal diameter.	12.25 mm. corneal diameter.
20.5 x 22.5 mm. Oval, overall diameter.	20 x 22 mm. Oval, overall diameter.

Decentration of corneal portion: 1.5 mm. in the long axis.	Decentration of corneal portion: 1.0 mm. in the long axis, and 1.0 mm. in the short axis.—down 6 in.
Optical specification:	Optical Specification:
—16.75 D. sph.	—15.00 D. sph.
Vertex distance, 5 mm.	Vertex distance, 5 mm.
decentered to give 3Δ	decentered to give 3Δ
prism diopters base-down.	prism diopters base-up.
V.A. 6/12 minus 1.	V.A. 6/9 minus 1.
Final position of contact lens in the eye at 180°	Final position of contact lens in the eye at 160°

8 mm. reduced optics, O.U.
Binocular V.A. 6/9 minus 1.

COMMENT

This is a refractive case of a high myope with a large degree of vertical phoria where contact lenses were prescribed for improvement of visual acuity, increasing the field of vision, reducing abberrations and stabilizing the binocular vision as far as this is possible.

In view of the external and internal ophthalmoscopic findings it was thought advisable to refer the patient to his ophthalmic surgeon beforehand in order to get his approval for the fitting of contact lenses.

The present refraction is near enough the same as the correction at present worn by the patient. The visual acuity with a spectacle correction could not be improved.

The horizontal muscle balance is near enough normal and need not cause us concern. The vertical phoria, however, proved most unstable from day to day. At four examinations it varied as much as from 6 Δ to 12 Δ prism-diopters of right hyperphoria. With the corrected prismatic contact lenses, full and improved binocular vision is present and the patient never experiences diplopia, not even in the evenings, as with the spectacle correction. Although the ductions are somewhat restricted, particularly horizontally, they may be considered satisfactory as the elongated eyeballs restrict the motility.

Monocularly, the patient was just able to read J2, but binocularly he could read J1 with a little effort, with his contact lenses in place.

Before having his final lenses made, the patient performed a four hour tolerance trial and in reporting back observed that he easily could have carried on longer. No Sattler's veil was observed. His eyes remained perfectly white and clear throughout. His comfort was excellent although he, of course, was very visually handicapped. After the use of the trial lenses the patient was anxious to obtain his own optically worked contact lenses.

The final contact lenses were then made and the patient was taught

insertion and removal by the fingers alone. This he mastered quickly. The final cosmetic appearance was very good.

Six months later the patient reported for his first periodic check-up. He has been wearing his contact lenses from 9:30 a.m. to 7:00 p.m. with only a one hour break around 1:00 p.m. He is most satisfied with his improved visual acuity and particularly with his wide field of vision. He is not worried by bright light any more than with spectacles but finds contact lenses more comfortable in a cold atmosphere than in a warm or stuffy one. During the entire six months' period the patient experienced diplopia only once. The patient finds it difficult and feels handicapped in having to fall back upon his spectacle correction when the contact lenses are not worn. He hopes to acquire an all-day tolerance in the not too distant future.

SUMMARY

In this case, contact lenses were prescribed for high myopia to improve visual acuity, increase the field of vision, reduce aberrations and eliminate the need for strong heavy spectacle lenses. The patient's vertical phoria was corrected by including prisms in each contact lens. The base of the prism was blended into the external transition of the contact lens to give maximum comfort. Because of the ophthalmoscopic findings an ophthalmic surgeon's opinion was sought before fitting the contact lenses. Clinical results met all expectations.

37 MANCHESTER STREET
LONDON, W. 1., ENGLAND.

ABSTRACTS

ABSOLUTE THRESHOLDS AND NIGHT MYOPIA. J. M. Otero, L. Plaza and F. Salavarri. (Institute of Optics, Madrid, Spain.) Journal of the Optical Society of America. 39.2.167-172. 1949.

Various phenomena associated with night myopia have been investigated during the last decade. An apparent myopia of approximately one diopter has been repeatedly observed under dark adaptation conditions. In 1943, V. Ronchi reported that, when night myopia was corrected by the proper spectacles, many more stars could be seen than with the naked eye.

The authors measured the absolute thresholds of four subjects each of whose night myopia was suitably corrected by spectacles. More than 50,000 determinations were made so that statistical methods could be applied to the results. Each observer was emmetropic and dark adaptation was achieved in complete darkness for at least 30 minutes. Measurements were made with test fields which subtended angles from 30 seconds to 11 minutes for the fovea and for retinal zones 3°, 9°, and 15° from the fovea.

A 50 per cent decrease in the absolute threshold was found when night myopia was compensated. This is reasonably explained by the fact that all the luminous flux distributed in the blurred image during normal, uncorrected observation is constricted into a much smaller surface when the night myopia is corrected.

B. ROSETT

A MODIFICATION OF JAVAL'S RULE FOR THE CORRECTION OF ASTIGMATISM*

J. Donald Kratz† and William G. Walton, Jr.‡
Pennsylvania State College of Optometry
Philadelphia, Pennsylvania

In the history of refraction the last condition to receive adequate attention was astigmatism. It was not until 1801 that Thomas Young demonstrated the phenomenon of astigmatism in his own eye. Young further demonstrated that most of the astigmatism present occurred on the anterior surface of the cornea. Correction of astigmatism in the eye was not practical until Airy demonstrated the grinding of a cylindrical lens about 26 years later.

The first carefully executed measurements of the corneal surface were done by Helmholtz after his development of the ophthalmometer. The ophthalmometer uses the anterior surface of the cornea as a reflecting convex mirror and by observing the effect on double images determines the radius of curvature which, by means of an assumed index, can be converted to dioptric value. The difference in dioptric value of the principal meridians will then be a measure of the corneal astigmatism.

Javal was one of the earliest investigators to establish the use of the ophthalmometer clinically. By means of numerous investigations he established the rule known today as Javal's rule. A quote from the writings of E. Javal will serve as an excellent summary of his statements of the facts as he saw them.[1]

> This is also the place to make the observation that all that I have said about static astigmia of the lens applies to strong astigmia. There are, I believe, two parts in static astigmia of the lens, the one, which I have spoken of in that which proceeds, and which is proportional to the astigmia of the cornea, and in the same meaning, and the other which is almost constant and about 90 $\pm$ 0.5 or 90 $\pm$ 0.75, a figure found also by M. Bull and M. Chibret. It results that, for example, when the cornea is strictly spherical, one should expect to find a total inverse astigmia of about 0.5. The formula which gives the total astigmia as a function of corneal astigmia in the eyes where the meridians divert little from the vertical and from the horizontal would then be in the form
>
> $$As.\ t = K + pAs.c$$
>
> and in this formula "K" would be about —0.5 and "p" about 1.25. The application of this formula is given respectively for:

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*Read before the annual meeting of the American Academy of Optometry, Winston-Salem, North Carolina, December 6, 1948. For publication in the July, 1949, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

†Optometrist. Fellow, American Academy of Optometry. Assistant Professor in Optometry.

‡Optometrist. Fellow, American Academy of Optometry. Instructor in Optometry.

As.c =	—1	0	1	2	3	4	5
As.t =	—1.75	—0.5	0.75	2	3.25	4.50	5.75

which would explain how, in the neighborhood of 2 D. of direct corneal astigmia, the total astigmia is equal to the corneal.

The writings of Javal mention G. J. Bull as a source for the value of the "K" term in the equation. The value of the "K" term was expressed by E. Javal as a .50 but in the writings of A. Javal we find Bull quoted as saying the value should be .75. A. Javal's writings as translated in Norris and Oliver are as follows:[2]

For the present we may adopt, as fairly in accord with the data derived from observation, a formula, of the first degree, of the form

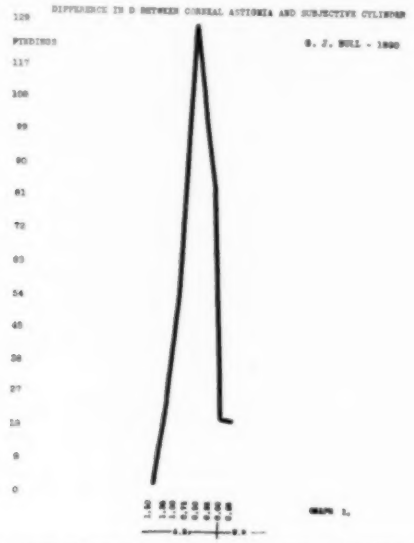
$$y = a + bx.$$

The factor "b", whose value has also been determined empirically, depends, probably, upon a deformation of the crystalline lens, giving rise to an astigmatism proportional to that of the cornea, — to a sympathetic astigmatism, we might almost say. In this coefficient, which has been found to be equal to about 1.25, is included also the change in the effective value of the cylindric glass due to its distance from the cornea when the eye is examined subjectively.

Inserting these numerical values of "a" and "b" in our formula, we have

$$y = -0.75 \text{ D.} + 1.25\ x.$$

Since this confusion exists, the writings of G. J. Bull were consulted, and his statistics were graphed as follows: Graph 1. The following is a quote from Bull's discussion of the topic:[3]



GRAPH 1.

The results of these observations that in the cases of astigmic with the rule and against the rule, it seems you have within the interior of the eye a static state which produces an astigmic against the rule of about .50 to .75 D., that which corresponds

approximately to the average of the difference which I have found. The hypothesis appears to be confirmed by the recent experiences found by M. Tscherning at the laboratory of the Sorbonne, etc.

In order to use the ophthalmometer findings with accuracy it is necessary to determine the factors which cause the variance.

It was recognized by Javal that the terms as he introduced them were not the final answer.[4]

[4] These lines, with which we had terminated our communication to London, in 1881, have been constantly presented to our group for ten years, and this work has led us to the empirical formula on page 131, about which it remains for us to better determine the co-efficients and to which it would be necessary to add other terms.

It was suggested further by Ostwaldt[5] that a portion of the error was due to the effectivity changes in moving a correcting cylinder from the cornea to the position of the correcting lens. The role of effectivity in the variation between the corneal astigmatism and the correcting cylinder was clearly adduced by the experiment of Javal and Pfliiger. They both refracted the same group of patients with Javal correcting in minus cylinders and Pfliiger correcting in plus cylinders. On this group of identical patients they found their results varied by an appreciable amount. The explanation of the discrepancy lies in the different degree of change occurring in moving the plus and minus cylinders from the cornea to the plane of the correcting lens. This point is clearly explained by Sheard in a case of 4 D. of corneal astigmatism which will require a —4.25 cylinder if one meridian of the eye is emmetropic and a +3.25 cylinder if the principal meridians of the eye are 6 D. and 10 D. respectively.

In later years, Neumueller constructed a table of computed values for the variation between the corneal astigmatism and the correcting cylinder. In this table both the spherical and cylindrical elements are given their proper weight and the optical allowances for effectivity changes were carefully computed. When refracting, this table may be applied in determining the subjective or objective cylinder power after due allowance has been made for the optical changes. In this paper the variations of the cylinder due to effectivity changes were placed in the last term of the equation. Javal's 1.25 As.c is called the "expected cylinder" which is the cylindrical correction after the corneal astigmatism has been moved to the plane of the correcting lens.

The "K" term of Javal's equation requires considerably more attention. The value of the "K" term has been given variously as .75 D. against-the-rule, or .50 D. against-the-rule in Javal's original estimate. In this investigation we have taken 295 eyes and recorded the variance between the "expected cylinder," as calculated in the pre-

vious paragraph and the prescribed cylinder which was the subjective cylinder. These cases were all cases which had returned several times over a peroid of 10 to 20 years for periodic examinations, thus indicating satisfaction with the prescription as worn. All cases were analyzed in an effort to determine the difference between the subjective cylinder and the "expected cylinder" when the patients were satisfied with the cylinder and sphere of the subjective. In recent years this difference between the "expected cylinder" and the subjective cylinder has been called the physiological astigmatism. In the earlier writings of Tscherning, Gullstrand, Donders, and others, the term, "physiological astigmatism," refers to the small amount of corneal astigmatism found in a majority of cases. This use of the term can be illustrated by the following quotation:[6]

> However, although the curvature of the optical zone of the cornea is nearly spherical both vertically and horizontally, this is not the case with the zone as a whole. For the normal condition is an appreciable astigmatism. This PHYSIOLOGICAL CORNEAL ASTIGMATISM was definitely ascertained by the ophthalmometric measurements carried out first by Nordenson.[2] Concordant results of various investigators show that its average value amounts to between 0.50 and 0.75 dptr, and that the section of least curvature is not very far from the horizontal direction of the longitudinal extent of the eye-slit. As evidence thereof, Steiger's figures may be used. He found a mean value of 0.78 dptr. in 3,170 eyes. But when the eyes were left out of account that had an astigmatism of more than 2.0 dptr., which are always to be regarded as pathological cases, he obtained with 3,073 eyes an average value of 0.70 dptr., and in two-thirds of these the corneal astigmatism was between 0.50 and 1.0 dptr., and in nearly seven-eighths of them between 0.25 and 1.25 dptr. In 89.4% of the eyes the direction of the section of least curvature was horizontal.

The use of the term, physiological astigmatism, was associated with the statistical evidence that it tends to become less with-the-rule or more against-the-rule as the age increases. This is suggested by the figures of Faehndrich as reported in Sheard's Physiological Optics[7] and by the writings of Landolt, Tscherning and Gullstrand. These authorities used the term physiological astigmatism to mean a small amount of corneal (usually up to 1.5 D.) which they found to be very common as contrasted to the pathological astigmatism which was 2 D. or over.

In the more recent literature there have been tables purporting to show an increase in physiological astigmatism with age. The table is frequently given as:

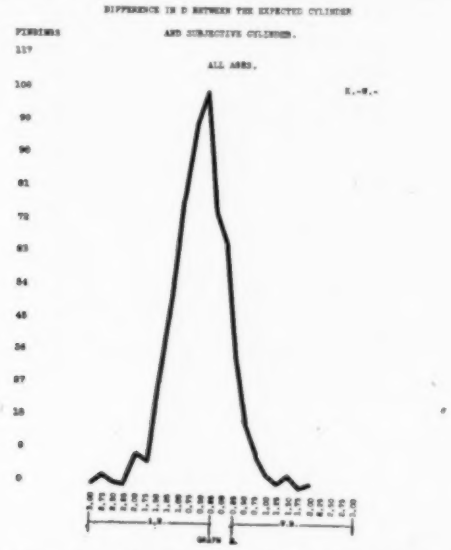
.25 A. R. to 30 years of age.
.50 A. R. — 30 to 60 years of age.
.75 A. R. over 60 years of age.

In searching the literature the statistical source of this table could not be determined. It should be noted that the newer use of the term,

[2]E. Nordenson. Recherches ophthalmometriques sur l'astigmatisme de la cornee chez les ecoliers de sept a vingt ans. Ibid. XC. 1883.

physiological astigmatism, is to describe the variance between the expected cylinder and the final subjective cylinder. It is this latter definition which the authors intend in the future use of the term.

In the analysis of the physiological astigmatism a definite peak in our findings occurs at .50 A. R. Graph 2. This finding was sub-

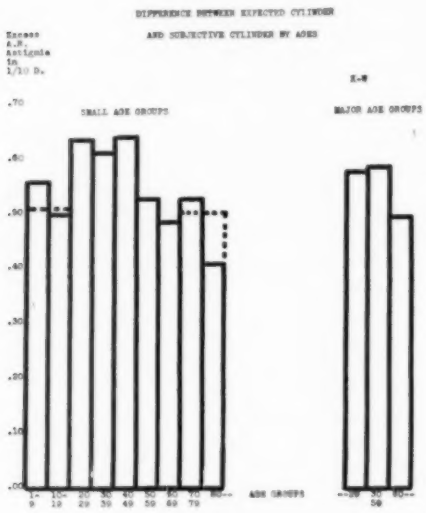


stantiated on breaking down the physiological astigmatism according to the different age groups. Graph 3 demonstrated the consistency of the .50 A. R. at the various age levels.

The statistics of Faehndrich show a trend of total astigmatism toward less with-the-rule or more against-the-rule. Graph 4. Our statistics on the frequency of corneal astigmatism with-the-rule and against-the-rule by decades bear out this trend. Our analysis of the frequency of total astigmatism with-the-rule and against-the-rule by decades follows very closely the results of Faehndrich.

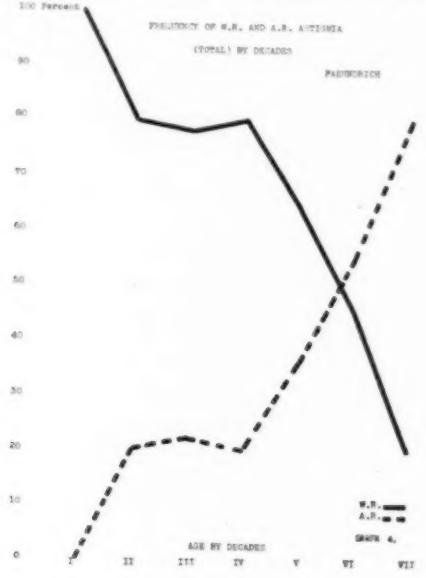
Since the difference between the expected cylinder and the subjective cylinder remains relatively constant at 0.50 D. against-the-rule for all ages, as the total astigmatism increases in against-the-rule throughout life the cause of the increase must be a change in the corneal astigmatism. This viewpoint is demonstrated by Graphs 5 and 6.

The average length of time between the first and last visit was 13.81 years with no patient included whose span was less than 10 years

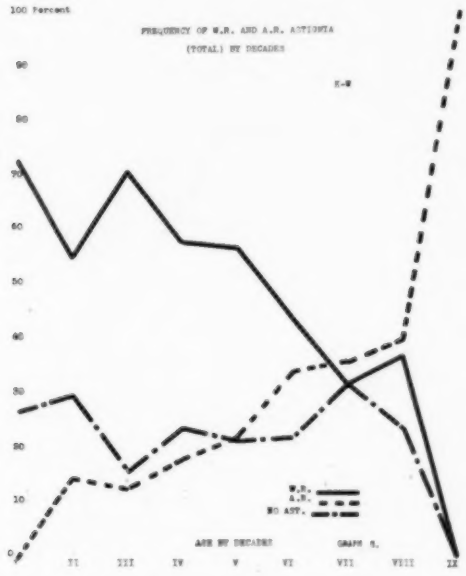


GRAPH 3.

or more than 21. In that length of time most patients had returned approximately four times. Over the 14 years, the subjective cylinder did



GRAPH 4.



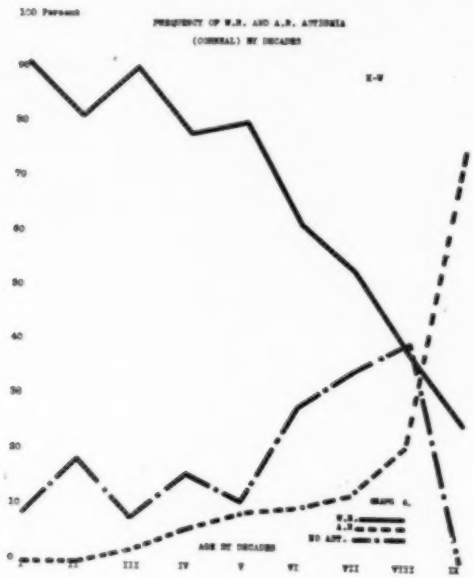
not change more than ± .25 D. in 60.2 per cent of the cases. Graph 7.

As a matter of interest the spherical changes were also analyzed. Here a slightly different picture presented itself. The spherical elements change in the direction of greater plus more frequently than a greater minus. The largest number of changes were a 0.25 D. increase of plus over a period of approximately 14 years. 30.10 per cent of the cases, however, show a change of ± 0.25 D. Graph 8. This is an agreement with the clinical experience of many practitioners as there are more patients tending to develop manifest hyperopia through the years than patients who develop more myopia. This is sometimes overlooked because of the myopic progression encountered in children with its concomitant difficulties. The total number of patients with myopic progression is comparatively less than those with hyperopic conditions.

In more recent years there have been several investigations of Javal's rule and variations of the rule presented in the literature. An excellent summary of these rules is presented by Bannon & Walsh:[8]

(a) Sutcliffe's Rule: For with-the-rule astigmia, using minus cylinders, add one-half the amount of the corneal astigmia to itself and deduct one diopter. For against-the-rule astigmia, using minus cylinders, add one-third to the astigmatism indicated by the keratometer.

(b) O'Shea's Rule: The corneal astigmatism plus one-half diopter against-the-rule (allowance for internal physiological astigmatism) is added to the spherical "cor-



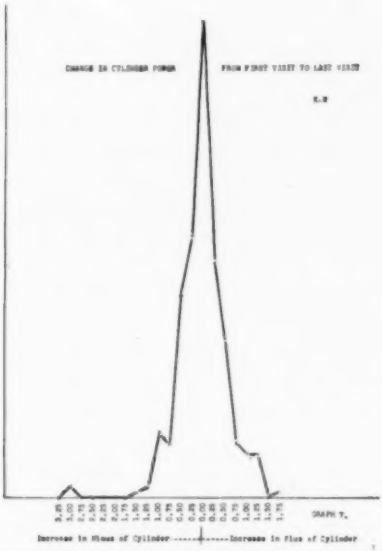
neal equivalent" emetropia and both are modified by a calculated table to determine their values when placed 15 mm. from the cornea.

(c) McCulloch's Rule: In with-the-rule cases, add one-eighth of the corneal astigmia reading to itself and subtract 0.75 D.; in against-the-rule cases add one-eighth of the corneal astigmia reading to itself and add 0.75 D.

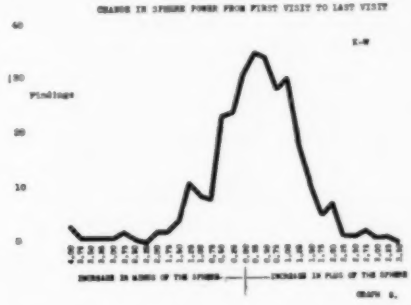
(d) Ryer and Hotaling's method consists in finding the cylindrical lens, set at the wearing distance before the eye, through which the ophthalmometer indicates a half-diopter with-the-rule astigmia. This lens with its axis rotated 90° represents the correction of the total astigmia.

(e) Neumueller made a study of the effect of the spherical error on the correcting cylinder (placed 15 mm. from the cornea) as determined by the ophthalmometer. For low ametropias the effect is negligible. In cases of myopia, the correcting cylinder will be more than the ophthalmometer readings; when combined with hyperopia the cylinder will be less than the ophthalmometer findings. Neumueller also studied the effect of physiologic astigmia in cases where the ophthalmometer indicated oblique axes. In this case the axis of the correcting cylinder will be between the corneal axis and 90°. (all astigmatic corrections being in minus cylinders). The smaller the corneal astigmatism relative to the physiologic astigmatism, the more will the axis of the correction cylinder deviate from the axis determined by the ophthalmometer.

As a further investigation of Javal's rule, we may quote the work of Fry and Mote[9] who reported an analysis of 100 cases (40 from the practice of Ryer and Hotaling and 60 from that of Mote) in the application of Javal's rule. Their conclusion is that Javal's rule is applicable statistically but that variations may occur in individual cases.



The modification of Javal's rule which we suggest is most nearly that of Ryer and Hotaling.[10] The process of Ryer and Hotaling was to calculate the expected cylinder by means of Neumueller's tables and then make an allowance of .25 D. to .75 D. depending on the age



of the patient. They used the table of physiological astigmatism reported earlier in the article where a gradual increase in the against-the-rule astigmatism occurs as the age increases. Our statistics do not support this table but rather show a relatively constant physiological allowance of .50 against-the-rule and the "p" term will be the expected

cylinder as calculated from Neumueller's[11] tables. In order to make the use of the equation very simple the .50 against-the-rule may be substituted as a plus cylinder axis 180° or a minus cylinder axis 90° as the need may rise.

It might be useful to consider some of the possibilities which may explain the cause of the .50 against-the-rule physiological astigmatism. It should be remembered that the comparison was made between the subjective finding and the ophthalmometer reading. This choice of the subjective over the objective findings seems to be shared by Bannon and Walsh when they say:[12]

> We do not feel that these two tests alone are adequate or sufficiently exact to warrant prescribing for most patients without recourse to some form of subjective verification or modification.

This viewpoint is also expressed by Lancaster[13] in his article on subjective astigmatic tests when he suggests that only the patient can choose which portion of the astigmatic bundle he cares to use for his visual perception.

The complex character of this astigmatic bundle can be adduced from this quotation of Gullstrand:[14]

> Sturm discovered that all the rays of a bundle go approximately through two mutually perpendicular focal lines, provided the aperture of the bundle is infinitesimal as compared with the distance of the focal lines from the stop and from each other. But in oblique incidence of light in optical instruments the latter condition is not even approximately the case, and in the case of the eye the so-called astigmatic difference is as a rule less than the diameter of the pupil; so that as a matter of fact the notion of these focal lines is fundamentally false. . . . . However, the aberration in the eye as ascertained by a study carried out in this way was found to be so great, and the blur circles on the retina even with the best focusing turned out to be so large, that the role in the imagery assigned to the narrowest cross section of the bundle cannot possibly be correct.

If the astigmatic bundle is so complex it is certainly reasonable to assume that different patients may choose various portions of the bundle, thus a subjective test is the ultimate point of decision.

The possible causes of the physiological astigmatism are ably enumerated by Sheard.[15]

(1) Astigmatism by incidence. This is the against-the-rule astigmatism incurred because of the lack of centering of the optical elements of the eye and also because of the angle alpha (the angle between the visual axis and the optic axis). Sheard constructs a table showing the effect of the various values of the angle alpha.

Total Astigmatism—	Angle Alpha 1°	5°	10°
Corneal	.02	.35	1.35
Lenticular	.01	.14	.54
Total	.03	.49	1.89

This astigmatism is always against-the-rule.

(2) Astigmatism due to lens obliquity. Here he quotes Percival's *Optics* and Laurance's *General Practical Optics* and demonstrates by calculation how a tilt of the crystalline lens will alter the spherical power and produce a cylindrical (astigmatic) effect.

(3) Astigmatic Accommodation. Here Sheard points out some of the opinions on both sides of the question and lists the authorities who discuss the problems. Sheard finishes this discussion with five points which make astigmatic accommodation a possibility.

At some points in the literature it has been suggested that the physiological astigmatism may be a result of the action of the posterior surface of the cornea. This is not an unreasonable assumption but it should be pointed out that even though Gullstrand found a variance between the anterior and posterior radii of curvatures for the cornea by means of the Nernst lamp, he still concludes the index of the cornea and aqueous humor are the same when he considers the findings of Helmholtz and Freytag on the refractometer.

Any rule for ophthalmometric findings, if held to strictly, will fail to produce the desired results. We would say that the chief value of the ophthalmometer is as an indicator of what to expect for the subjective cylinder. Since only 18 per cent of our cases show a —0.50 D. difference, this would not allow for strict adherence to the rule. Since the clinical error for both the ophthalmometer reading and the subjective cylinder is ± 0.25 for practical purposes we can include an expected K-subjective difference from 0.00 to —1.00.

From a consideration of the above points it is not alarming to find that not all cases present the .50 against-the-rule physiological astigmatism which is the statistical high point. 73 per cent of our cases encompass a 0 to 1.00 D. difference. Thus we can expect our ExK-Sub difference to be no greater than 1.00 D. Jackson[16] points out that 80 per cent of his cases fall within this limit. A case of a greater difference should be a caution signal to check our subjective cylinder.

As a further investigation into the variables in physiological astigmatism it is suggested by the authors that a study be made with allowances as suggested in this paper plus a corollary measure of the angle alpha in an effort to see if allowance for this variance will further enhance the accuracy of this study.

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ABSTRACTS

SOME DISTORTIONS OF SPACE. L. F. Madigan. Bulletin of the Massachusetts Society of Optometrists. 29.9.251-253. 1949.

Monocular clues for space perception including color, sharpness, apparent size, overlay, perspective, shadows and parallax are reviewed briefly. The basis of binocular space perception is the disparity in images due to lateral separation of the two eyes. A combination of both monocular and binocular clues constitutes the resultant perception in people with binocular vision.

Testing for spatial distortion due to binocular clues may be accomplished only when monocular clues have been eliminated as, for example, in the "Leaf Room."

Three cases are cited which describe the binocular spatial distortions and associated symptoms.

The author urges a wider application of corrective procedures as much more knowledge is gained about visual space and its measurement.

R. E. B.

REPORT ON THE RENSHAW STEREO-DISPARATOR*

Salvi S. Grupposo†
Southbridge, Massachusetts

One of the most recent developments in stereoscopic instrumentation is a device known as the Renshaw stereo-disparator. Owing to the interest which has been shown in this instrument, the following report has been prepared.

Essentially a Brewster stereoscope, the instrument has an adjustable base supporting the viewing lenses, chin rest, target holders, and central calibrated rod. To either side of the central rod are the guide bars for the targets, and adjustment controls. The eyepiece, containing the viewing lenses, is in the form of two tubes which appropriately limit the field of view. A small lamp, mounted on the upper surface of the eyepiece housing, serves to illuminate the targets. Three cells are provided for each viewing tube for trial lenses and occluders. The viewing lenses are five diopter lenses incorporating baseout prisms and having a minimum of chromatic aberration and field distortion.

The central rod is calibrated in centimeters and equivalent dioptric powers. The zero, or infinity, position is at twenty cm., and when the indicator on the target holder coincides with this scale marking there is no demand upon accommodation. Two bars or guides on either side of the central rod represent the target paths. Inclination of these guides with respect to the central rod determines target separation and therefore the demand upon convergence.

Two control knobs and appropriate scales are provided. Separation of the targets in the focal plane of the lenses is determined by the far control, while the near control determines their separation in the plane of the lenses.

The far or distance scale is in half centimeter divisions and provides a total displacement of two centimeters outward from the zero mark and one-half centimeter inward. The lens plane, or near scales consist of an inner tube scale and a smaller sleeve scale, both designed to compensate for their position relative to the lens plane. Each main division is equivalent to one cm. displacement in the plane of the lenses. A total displacement of five divisions outward is possible on the inner

*Submitted on May 20, 1948, for publication in the July, 1949, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.
†Optometrist. Member of staff, Bureau of Visual Science, American Optical Company.

tube. The sleeve scale has divisions comparable to those of the far scale but reversed in direction.

Both target holders may be decentered laterally for decentered targets and vertically to compensate for hypertropia or hyperphoria. A hand grip at the rear center of the target holder provides control of forward and backward movement of the targets.

The ordinary stereoscope is an important and helpful instrument, but as pointed out by Stoll and Boeder[1] its general use in visual training is handicapped by the following limitation. The usual fixed target separations prohibit the maintenance of the proper relationship between accommodation and convergence when the targets are in motion. For any particular separation of the targets, there is only one position in which the demands on accommodation and convergence induce the proper relationship. All other positions, in some degree, upset the normal relationship by placing abnormal demands on convergence. The abnormal relationship thus produced has been used advantageously in some cases as a means of disorganizing inefficient accommodation-convergence patterns. However, for direct development of efficient patterns of association between accommodation and convergence, its value is limited. Several stereoscopic instruments have been developed to overcome this limitation but, in the author's judgment, none of these has been entirely satisfactory.

The stereo-disparator obviates this restriction providing an easy measure of control over accommodation and convergence. Coordinated changes in accommodation and convergence are provided by means of the triangulating mechanism for guiding the targets. As changes in demands on accommodation are made by moving the targets toward or away from the eyes, coordinated changes in the demands on convergence are made simultaneously by moving the targets over guides previously set to provide the required target separations. Thus, for all movements of the targets, it is possible to position the guides to induce the normal functional relationship between accommodation and convergence. Likewise, the guides may be adjusted to introduce clinically desirable prismatic effects. An adequate range of prismatic effects is generally obtainable in this manner and the range may be extended, if necessary, by use of auxiliary prisms.

The optical principles of the stereo-disparator have been discussed comprehensively in the paper "Stereoscope as a Training Instrument"[1]. Zero settings of both distance and near scales provide the condition for orthoptic viewing, so called because accommodation and convergence are in normal correspondence for single seeing. At this setting of the

scales, the path followed by the targets when moved toward or away from the patient is referred to as the orthoptic path. The optical effect corresponding to this movement is equivalent to the demands on accommodation and convergence when viewing without instrumentation an approaching or receding object under normal conditions of binocular seeing. Deviations from the orthoptic path provide prismatic effects and may be determined mathematically in accordance with the following simple formula:

$P = rA + qD$, where

P = the deviation from the orthophoric position in prism diopters, with a plus value indicating convergence and a minus value indicating divergence.
A = the diopters of accommodation in demand.
D = the dioptric power of the lenses in the instrument (5D).
r = the displacement from the orthoptic path in the plane of the lenses, measured in centimeters, positive when the displacement is nasalward, negative when the displacement is temporalward.
q = displacement from the orthoptic path in the focal plane, measured as above.

It is to be noted that P in the formula represents the prismatic effect before one eye only. The total prismatic effect before both eyes is thus equal to 2P.

A simple example should suffice to illustrate application of the formula in obtaining desired settings. Suppose that the instrument is to be set to obtain a divergence or base-in effect of 2 Δ before each eye at distance (infinity position) and 8 Δ at near (33 cm.). Using the formula $P = rA + qD$:

(1) Distance scale setting:
$P = -2$ (minus sign because a divergence or base-in effect is desired)
$rA = 0$ (no accommodation is demanded at infinity or distance position)
$D = 5$ (constant power of the viewing lenses)
$q = ?$
Therefore, substituting in the formula:
$-2 = 0 + 5q$
$5q = -2$
$q = -2/5$ or -0.4

(2) Near scale setting (33 cm.):
$P = -8$
$A = 3$ (diopters accommodation demanded at 33 cm.)
$q = -0.4$ (as found above)
$D = 5$ (constant factor)
$r = ?$

Thus:
$-8 = 3r + (0.4)(5)$
$-8 = 3r - 2$
$3r = -8 + 2 = -6$
$r = -6/3 = -2$

The calculations indicate that the distance scale is to be set at 0.4 measured outward from zero. The near scale setting is made by aligning the 0.4 of the sleeve scale with 2.0 measured outward from zero on the inner tube scale.

While the formula is a means of providing settings for desired prismatic effects, the following elementary method is more convenient for general use. Consideration is given toward providing the total prismatic effect for both eyes in line with usual thinking regarding ocular deviations.

It will be remembered that the distance scale is in centimeters. For every 0.1 centimeter displacement of the distance scale from zero, a total prismatic effect of 1 Δ is introduced. Therefore, distance prismatic effects are provided by setting the scale at the figure obtained in multiplying the total prism effect desired by 1/10 or 0.1. Base-in, exophoria, or divergence effects are measured outward from zero. The effect is to increase the separation of the targets. Base-out, esophoria, and convergence effects are measured inward from zero, decreasing the separation of the targets.

Prism effects at near (33 cm.) are obtained as follows. If the desired near and distance effects are to be similar in type, for example, both base-in or base-out: multiply the numerical difference by the factor 1/6. If the near and distance effects are to be dissimilar in type, add the two together numerically and multiply the sum by the factor 1/6. The amount of displacement from the orthoptic path is obtained in this manner. The direction of the setting (the sign convention is not used) is determined by employing the appropriate one of two rules:

(a) If the near effect is to be one of greater relative divergence or lesser convergence than at distance, the setting is measured out from zero.

(b) If the near setting is to be one of lesser relative divergence or more convergence than at distance, the setting is measured in from zero.

It is interesting to note that providing a constant prism effect from distance to near constitutes a special case in which the displacement at near is always zero. Thus, for constant prism effects the near sleeve scale can be automatically aligned with the zero of the inner tube scale immediately after the distance setting is determined.

Both formula and non-formula methods obviate the use of rigid tables providing a wide variety of patterns.

Targets for the instrument consist of two series designed by Dr. Samuel Renshaw. The Renshaw Visual Diagnostic and Training Split Stereo-grams and a third diagnostic and visual training series produced by American Optical Company.

The instrument is adapted for both diagnosis and visual training. Visual skills may be taken at near, far, or at any intermediate point.

Likewise, visual training may be performed at near, far, or at any intermediate point under normal or abnormal functional relationships. The fact that the desired target separations may be obtained automatically for all distances along the central rod makes the stereo-disparator a means of transferring plus acceptance from near to far. This may be accomplished by moving the targets from a near position out toward the zero, or far position, using appropriate amounts of plus and constantly attempting to maintain clearness of the targets as they follow the path for orthoptic viewing.

Accommodative rock, second degree fusion, base-in and base-out ductions training, and other clinical applications of the stereo-disparator have been discussed extensively in the papers of the Optometric Extension Program[2].

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ABSTRACTS

PRACTICAL PROBLEMS PERTAINING TO PRESBYOPIA. J. E. Lebensohn. American Journal of Ophthalmology. 32.1.22-30. 1949.

Many useful pointers are presented in this paper. Although women have a greater life expectancy than men, they become presbyopic some years earlier. The accommodative ability of each individual presbyope should be determined precisely rather than assumed because of age from a statistical table of accommodation which merely gives an indication but does no more.

Various tests for determining the presbyopic add are given. These include: The two-line test, the duochrome test and the four-point type which are made with a near-vision chart designed by Lebensohn.

Several case histories are given which illustrate the significance of the various findings. Information is presented on the choice of bifocals and the needs of those in various occupations.

Anisometropic corrections with their unequal induced vertical prismatic effects when the wearer looks down as in reading are discussed together with the various types of bifocal segments. The effect on the cylinder axes from the horizontal prismatic effect of displacing the segment nasally is another point of consideration. Near additions in cases of subnormal vision are also discussed.

The author states that trifocals are being used more extensively—their present use being over 12 times that of 1940. The Beach multifocal lens is described but apparently it is not readily available. Several hints are given concerning the selection and fitting of the proper segment for the carpenter, pianist, housewife, golfer, etc. In general, much valuable information is contained in this short article.

R. E. B.

BIFOCALS FOR PREPRESBYOPIC PATIENT WITH VISUAL FATIGUE—A CASE REPORT*

John R. Hubbard†
Cleveland, Ohio

CASE HISTORY

G. M., female, age 34, first appeared for a visual analysis February 14, 1946. She complained of being unable to read for any length of time without becoming uncomfortable and sleepy. She had always been a slow reader.

Her mother suffered from a congenital cataract condition. Her father experienced normal vision until he became presbyopic. She has a younger brother who does not like to read, and who did not attend college even though he has a high I. Q.

G. M.'s health history shows measles when eight weeks old and the need of glasses at six. She is troubled with occasional attacks of sinusitis located in the frontal sinuses. Her general health has been excellent. She was an "A" student in college but always had trouble reading due to fatigue and slowness.

PRELIMINARY EXAMINATION

The lids, sclera and conjunctiva were free of any abnormality. The pupillary reaction to light, direct, consensual and to accommodation was normal. Versions, rotations showed occasional deviations from what was expected.

The skills showed the following:

Simultaneous vision: negative.
Vertical imbalance: negative.
Lateral imbalance: esophoric trend.
Fusion: unfused to fused.
Acuity: 100% O. D. and O. S.
Stereopsis: about 20%.
Macular Suppression: O. D. slight.
Perimacular Suppression: O. D., intermittent, total.
Near Point:
Lateral imbalance: strong esophoric trend.
Fusion: unfused to fused.
Acuity: 100% O. D. and O. S.

These skills were taken through her old prescription which was O. D. + 0.75 D. sph. $\bigcirc$ — 0.75 D. cyl. axis 15. O. S. + 0.50 D. sph. $\bigcirc$ — 0.50 D. cyl. axis 175.

*Submitted as a portion of the entrance requirements of the American Academy of Optometry. Approved by the Examining Board. For publication in the July, 1949, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

†Optometrist. Fellow, American Academy of Optometry.

ANALYTICAL EXAMINATION

Habitual phoria at distance: 1 esophoria.
Habitual phoria at near: 4 esophoria.
Dynamic retinoscopy at 20 inches: O. D. + 2.50 D. sph.
Static retinoscopy: O. D. + 1.00 D. sph. ⌒ —1.00 D. cyl. axis 15.
O. S. + 0.75 D. sph. ⌒ —0.75 D. cyl. axis 175.
Dynamic retinoscopy at 20 inches: O. D. + 2.50 D. sph.
O. S. + 2.25 D. sph.
Dynamic retinoscopy at 40 inches: O. D. + 1.50 D. sph.
O. S. + 1.25 D. sph.
Subjective findings: O. D. + 1.00 D. sph. ⌒ —1.00 D. cyl. axis 15.
O. S. + 0.75 D. sph. ⌒ —0.50 D. cyl. axis 175.
Induced phoria at distance: 1 esophoria.
True adduction at distance: no finding.
Convergence at distance: 10/8.
Abduction at distance: 5/1.
Vertical phorias and ductions at distance: O. D. 3/1. 3/1.
O. S. 3/1. 3/1.
Induced phoria at near through subjective: 3 esophoria.
Cross cylinder, dissociated: O. D. + 2.50 D. sph.
O. S. + 2.25 D. sph.
Induced phoria through unfused cross cylinder: O.
Binocular cross cylinder: O. D. + 2.50 D. sph.
O. S. + 2.25 D. sph.
Induced phoria through fused cross cylinder: 1 exophoria to 2 esophoria.
Positive relative convergence: 20.
Positive fusional reserve: 23/15.
Negative relative convergence: no finding.
Negative fusional reserve: 12/5.
Vertical phorias and ductions at near: negative.
Amplitude of accommodation: 6.50 D. sph.
Positive relative accommodation: — 3.25 D. sph.
Negative relative accommodation: + 4.00 D. sph.

Being an accommodative fatigue type case, it became advisable to inhibit accommodation as much as possible at far and near, thus reflexly inhibiting convergence. Therefore, the following prescription was given in the form of a bifocal:

O. D. + 1.00 D. sph. ⌒ — 1.00 D. cyl. axis 15. Add + 1.00 D. sph.
O. S. + 0.75 D. sph. ⌒ — 0.50 D. cyl. axis 175. Add + 1.00 D. sph.

About six weeks after receiving her prescription this patient reported an easy adaptation to her bifocals and much greater comfort in reading. A battery of skills was run which showed a lessening of the esophoric trend, more normal fusion and the lessening of the supression tendency.

G. M. was again seen January 10, 1948, for a complete visual analysis. The patient thought, perhaps, her glasses needed to be made stronger as she was again becoming fatigued while reading.

The skills showed as follows:

Simultaneous vision: negative.
Vertical imbalance: negative.
Lateral imbalance: slight esophoric trend.
Fusion: fused.
Acuity: 100% O. D. and O. S.

Stereopsis: 50%.
Macular suppression: negative.
Perimacular suppression: negative.
Near point:
Lateral imbalance: slight exophoric trend.
Fusion: fused.
Acuity: 100% O. D. and O. S.

SECOND ANALYTICAL EXAMINATION

Habitual phoria at distance: 0.
Habitual phoria at near: 2 exophoria.
Static retinoscopy: O. D. + 1.50 D. sph. ⌒ —1.00 D. cyl. axis 15.
O. S. + 1.25 D. sph. ⌒ —0.75 D. cyl. axis 175.
Dynamic retinoscopy at 20 inches: O. D. + 3.00 D. sph.
O. S. + 2.75 D. sph.
Dynamic retinoscopy at 40 inches: O. D. + 2.00 D. sph.
O. S. + 1.75 D. sph.
Subjective findings: O. D. + 1.50 D. sph. ⌒ —1.00 D. cyl. axis 15.
O. S. + 1.00 D. sph. ⌒ —1.00 D. cyl. axis 177½.
acuity: 20/20 O. D., O. S., O. U.
Induced phoria at distance: ½ exophoria.
True adduction at distance: no finding.
Convergence at distance: 13/9.
Abduction at distance: 10/7.
Vertical phorias and ductions at distance: O. D. 3/1. 3/1. O. S. 3/1. 3/1.
Induced phoria at near through subjective: 0.
Cross cylinder. dissociated: O. D. + 2.75 D. sph.
O. S. + 2.25 D. sph.
Induced phoria through unfused cross cylinder: 3 exophoria.
Binocular cross cylinder: O. D. + 2.75 D. sph.
O. S. + 2.25 D. sph.
Induced phoria through fused cross cylinder: 4 exophoria.
Positive relative convergence: 20.
Positive fusional reserve: 28/20.
Negative relative convergence: 17.
Negative fusional reserve: 28/17.
Vertical phorias and ductions at near: negative.
Amplitude of accommodation: 5.00 D. sph.
Positive relative accommodation: — 2.50 D. sph.
Negative relative accommodation: + 2.00 D. sph.

Due to the low findings in induced phoria through the unfused cross cylinder: induced phoria through the fused cross cylinder: negative fusional reserve and amplitude of accommodation. it remains desirable to continue inhibiting accommodation both at far and near point. The following prescription was given in the form of a bifocal:

O. D. + 1.50 D. sph. ⌒ — 1.25 D. cyl. axis 15. Add + 1.00.
O. S. + 1.00 D. sph. ⌒ — 1.00 D. cyl. axis 175. Add + 1.00.

G. M. stated at the time of her progress report that she was again completely comfortable and reading extensively without discomfort or fatigue.

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AMERICAN JOURNAL OF OPTOMETRY
and ARCHIVES *of*
AMERICAN ACADEMY OF OPTOMETRY
Established 1924

Vol. 26 JULY, 1949 No. 7

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Publication and Academy Office: 1502 Foshay Tower, 821 Marquette Ave. Minneapolis 2, Minnesota

Annual Subscription, $5.00 in Advance; Canada, $5.50; Foreign, $6.00; Single Copies, 50c.

Original papers, scientific communications, clinical reports, books for review, and correspondence should be sent to the editor. Subscriptions and applications for single copies should be addressed to the circulation manager. Copy of advertisements must be sent in by the first of the month preceding their appearance. Communications with reference to advertising or other journal business should be addressed to the advertising manager. Academy correspondence should be addressed to Dr. Carel C. Koch, Secretary of the American Academy of Optometry.

Published Monthly by the
AMERICAN JOURNAL OF OPTOMETRY PUBLISHING ASSOCIATION

The American Academy of Optometry and the publishers of this journal have no objection to the reprinting by other magazines of any of the articles in this issue, provided such reprints are properly credited to the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

"SQUINT" IN THE LAND OF THE MAYAS

In the ancient world of the Mayas, according to Von Hagen, who quotes Stephens, it was thought attractive to be cross-eyed. In fact, for a considerable period of time between 800 A.D. and 1400 A.D., Maya mothers in Guatemala, Honduras and the Yucatán peninsula of Mexico attached small balls of red wax and feathers between the eyebrows of their newly born to cause the eyes to cross. So attractive was strabismus to these progressive, temple building, peoples that Itzamna, the god of writing, was himself always represented as having a convergent squint.

The noted American archaeologist, John Lloyd Stephens, of New York City, made his second exploration into this area in 1841. Stephens, accompanied by a British architect, artist and student of ancient buildings, Frederick Catherwood, and a young Boston physician, Dr. Samuel Cabot, Jr., made up the party. They arrived at Mérida, Yucatán in

October and started their arrangements to visit the time-mythed Copán land with its bizarre sculpture.

Before starting their jungle trip they noticed in Mérida the unusually high number of persons with squint. Stephens and Cabot came to the conclusion that this was an atavism of their Indian ancestry. Squint was no longer popular or stylish, yet many of the natives were so affected. Somehow word got around that Dr. Cabot could, by surgery, effect a cure for this condition.

According to Von Hagen[1], a 14-year-old boy, the son of a Mérida family that had befriended Stephens, was the first strabismus patient. A handsome, liquid-eyed boy, his features were singularly spoiled by the squint. After honing off the rust that had gathered on his finely-tempered Parisian instruments, Dr. Cabot explained to the parents, through Stephens, the *modus operandi* of the strabismus technique: the eye was secured in its orbit by six muscles, which regulated its movements up, down, inward, and out. Any overcontraction or underdevelopment of one of these eye muscles produced an obliquity in the eye called in their language *bisco*. He, Dr. Cabot, was now to cut without, unfortunately, any anesthesia, one of those eye muscles, after which, God willing, the eye would "fall" back into its normal position. As these muscles lie under the surface of the eye, it would be necessary to pass through its membrane. It was obvious that for so delicate an operation one could not use either a broadaxe or a machete. "In fact," Stephens concluded, "it requires a knowledge of the anatomy of the eye, manual dexterity, fine instruments, and Mr. Catherwood and myself for assistants." A cut of Cabot's knife, a piteous scream, and the boy, his eyes bleeding, got off the improvised table without the squint. *Milagro!* The success of Cabot's miracles swept Mérida.

The next morning, continues Von Hagen, their room was surrounded by a regiment of people and many squint-eyed boys. With two local medicos, Drs. Bado and Munoz, in attendance, patients selected at random yielded their inheritance of Itzamna to Dr. Cabot's knife. One, a huge gargantuan fellow, with widely spaced teeth, almost lost his eye when he jerked away from the incision; another, a small boy clad in the traditional white Yucatán shirt and drawers and only 10, could be heard among all the others saying in his small voice: "*Yo quiero, yo quiero*"—"I wish it, I wish it," climbed on the table and lay heroically immobile while he was cured of the strabismus. Then

[1]Victor Wolfgang Von Hagen. Maya Explorer, John Lloyd Stephens and the Lost Cities of Central America and Yucatan. The University of Oklahoma Press, 1948, pp. 210-211.

came an old general, the oldest in the Mexican Army, a flood of gray hair foaming over the collar of his frayed regimentals. He had fought as a volunteer with General Jackson at New Orleans, and that, in Stephens' eyes, was enough to allow him precedence; he submitted to two operations. The old general, leaving his blood behind him, was followed by a pretty young girl. She came with her *duena*. Terribly overwrought, the young lady jumped up from the operating table, then calmed by the *simpático* Senor Stephens she submitted . . . After that Dr. Cabot declared he had had enough. And so did Stephens whose head, according to Von Hagen, "was actually swimming with visions of bleeding and mutilated eyes." Yet it was not as easy to stop as it had been to begin. Their doors were crowded throughout the day with numbers sufficient to blot out the warm Yucatán sunlight, with clamoring white-clothed Maya people, all with squint, demanding to be treated . . . Everywhere they went in Mérida after the strabismus operations, they were followed by small boys who shouted: "There go the men who cure the biscos."

The jungle then received the explorers who in turn visited the great lost cities of Izamal, Chichén Itzá, Uxmal and a number of smaller centers. Stephens went on to fame as the father of American archaeology. Catherwood's drawings and lithographs made him world famous and Cabot (1815-1885) was destined to be one of America's most distinguished surgeons.

CAREL C. KOCH

CHANGE OF POLICY NEEDED REGARDING COMMERCIAL EXHIBITS AT OPTOMETRIC CONVENTIONS

Since the close of the war, the practice has been revived of high pressuring local and national distributors of ophthalmic products into buying "display space" at optometric conventions. Usually the convention committee rents a hotel room to a manufacturer or laboratory for the convention period at a rental rate several times that charged the association for the room. During the convention, the room is used to "display" spectacle frames—a bushel or so of frames dumped on a table constituting the commercial exhibit. In addition, the room serves as a gathering place for a type of optometrist who usually is no asset to a sponsoring association, and for non-optometric participants, who, through sheer boredom distract and disrupt the purpose for which the meeting was called.

This practice on the part of optometric societies is disgraceful. Such a setup detracts from the professional tone of the meeting, and the funds so provided can be better raised elsewhere.

Manufacturers and laboratory officials who are dragooned into this business, for the greater part, do so reluctantly. The individual costs of such doubtful good-will gestures run well into several hundreds of dollars, and the time of many key members of the staff is wasted. Multiply this by a dozen or so commercial exhibitors at each two or three day meeting and the tariff for this doubtful asset seems all out of proportion.

Recently, we regret to report, this practice on the part of certain optometric societies has reached new heights. Not only is commercial display space sold as before, but the recalcitrant laboratory official may become a "non-exhibitor for a donation," if he objects too strenuously to the idea of buying-in as a commercial exhibitor.

Such procedures are simply indefensible when conducted by otherwise representative optometric societies. Real scientific and educational exhibits have their proper place but many of today's commercial exhibits are a travesty. These have no place at serious technical gatherings of professional men and should be banned by organization leaders who sponsor conventions.

If this is not done, laboratory officials, supported by manufacturers should put a speedy end to this unnecessary drain upon their resources through concerted action on the part of their trade associations.

CAREL C. KOCH

NOCTURNAL MYOPIA

The subject of night myopia was reviewed by Tousey at the Winston-Salem meeting of the Academy. The author also presented the results of a recent study made of this condition at the U. S. Naval Research Laboratory, Washington, D. C.

According to Tousey, the emmetropic eye becomes from one to two diopters myopic when observing objects under dark night time conditions. This effect is termed nocturnal or night myopia. The magnitude of this effect and its dependence on brightness was measured for several subjects. It was found that nocturnal myopia starts with the shift from cone to rod vision and is not complete until the lowest brightnesses which can be seen are reached. By fully correcting the nocturnal myopia, visual range increases were secured which were as great as 75 per cent for emmetropes and even greater for myopes.

Experimental results were obtained by Tousey which indicate that nocturnal myopia is caused by the chromatic and spherical aberrations of the eye. The chromatic aberration acting together with the Purkinje Effect causes about 0.3 diopter of nocturnal myopia. The spherical aberration accounts for the major portion, from 0.7 to 1.7 diopters. The spherical aberration causes nocturnal myopia, he believes, because the center of the eye lens is the portion which determines critical focus at high brightness, while at low brightness the outer parts of the eye pupil determine the focus.

According to Tousey, accommodation was found not to be a cause of true nocturnal myopia, but, under certain conditions, may increase it. Homatropine produced in some subjects a change in the spherical aberration of the eye and a corresponding change in nocturnal myopia.

CAREL C. KOCH

SPECIAL REPORT

AMERICAN OPTOMETRIC ASSOCIATION CONVENTION REPORT*

Robert E. Bannon†
Hanover, New Hampshire

Long-awaited action on compulsory health insurance was taken by the American Optometric Association at its 52nd annual convention in Boston [June 26-29]. This action may be summarized by quoting the essential part of the resolution passed by the House of Delegates on June 29.

"RESOLVED, that the A. O. A. in annual meeting assembled, recommend that any bills relating to the national health should protect the right of the beneficiaries of this legislation to avail themselves of the professional services of optometrists without prior approval by a medical administrative officer or physician; to provide for assistance to schools of Optometry comparable to that proposed for the schools of other health professions; and to include representatives of the optometric profession on Boards and Councils established by such legislation; and be it

"FURTHER RESOLVED, that the enactment of any legislation pertaining to National Health Insurance or National Health Service which does not so provide, shall be vigorously opposed by the members of this Association, their patients and friends."

While the above resolution may be commended for its consideration of the professional rights and the welfare of optometrists, it does

*Submitted on July 1, 1949, for publication in the July, 1949, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

†Optometrist. Research Editor, Am. J. Optom. & Arch. Am. Acad. of Optom. Assistant Professor, School of Optometry, Columbia University, New York City.

not consider whether a national health program is good for the public. It simply says that if optometry is not included as an independent profession, we should oppose it. This implies that if optometry is included as an independent profession, we should be in favor of a national health program. The basic question of whether or not a national health program is good for the public is avoided. This straddling-of-the-fence attitude is hardly praiseworthy in a profession whose avowed purpose is that of eye care for the general public. Whether a national health program is, or is not, good for the citizens of this democratic country does not depend solely upon optometry's inclusion as an independent profession. There are considerations far more basic. The A. O. A. resolution states that if optometry is not included as an independent profession, the enactment of any national health legislation "shall be vigorously opposed." Does this mean that the A. O. A. will vigorously oppose the Ewing plan now being considered by Congress?

And, does A. O. A.'s stand mean that if the Ewing plan is changed to include optometry as an independent profession, we should endorse it without regard or consideration for the possible jeopardization of our democratic principles?

It would seem that the A. O. A. considers its duty to be more concerned with the welfare of optometrists than with the welfare of the public and of its members as citizens of this country. Other professions, even those which are included as independent professions in the current national health program now being considered by congress, have taken a stand on the question without regard to their participation in the proposed legislation but have presented their views solely on the basis of what they consider best for the general public and the democratic way of life.

Except for the A. O. A. middle-of-the-road stand regarding the national health program, the other resolutions passed were unequivocal with respect to the national public welfare and the enhancement of the profession of optometry.

Another significant resolution had to do with the removal of the Northern Illinois College of Optometry from the list of accredited schools and colleges of optometry. Relative to the latter action, Dr. H. Ward Ewalt, Jr., as chairman of the Committee on Education and Professional Guidance, gave a cogent summation of his committee's investigations regarding N. I. C. O. The salient reason for the discontinuance of N. I. C. O.'s accreditation was their refusal to comply with the Council's recommendation of a seven-man board of control. It appears that N. I. C. O.'s present board of control consists of only three members. The official details are expressed in the current (June, 1949) issue of

the JOURNAL OF THE AMERICAN OPTOMETRIC ASSOCIATION, pages 710-711, and the views of N. I. C. O. are presented in the OPTOMETRIC WEEKLY, June 16, 1949, pages 942-945. Albeit, the Northern Illinois College of Optometry has made many improvements in recent years in their educational facilities and acknowledging that this school has trained and graduated many capable optometrists, nevertheless, their refusal to comply with the Council's recommendation as have the other non-university schools, seems to present adequate justification for the Council's action. This was verified at the convention by an overwhelming vote by the House of Delegates to adopt and uphold the resolution presented by the Council on Education to discontinue accreditation of N. I. C. O.

By virtue of the great majority of opinion in organized optometry approving of the justice and wisdom of the Council's recommendation that non-university schools have a seven-man board of control consisting of at least four practicing optometrists, it is hoped that N. I. C. O. will concede its stand by joining with the other schools and will appoint a seven-man board of control so that it may fulfill, as have the other schools, the recommendations of the Council on Education and Professional Guidance of the A. O. A. which, in essence, are solely for the benefit of the profession of optometry. The Northern Illinois College of Optometry has made substantial contributions to optometry and it is hoped that it may continue to do so by regaining its accreditation and devoting itself to the teaching of optometry and the running of an educational institution in the manner which the majority of optometrists wish.

The reported attendance was 750, and the convention was eminently successful both from the quality of the educational lectures presented and the importance of the various business and organizational matters transacted with efficiency, dignity, and decorum befitting a professional society.

Prominent practitioners and educators who presented papers were: Leonard Carmichael, Ph.D., Tufts College; Glenn A. Fry, Ph.D., Ohio State University; John C. Neill, O.D., Pennsylvania State College of Optometry; Daniel Woolf, O.D., Columbia University; Marguerite Thoma Eberl, O.D., Milwaukee, Wis.; Foster Namias, O.D., Massachusetts School of Optometry; James H. Grout, O.D., Northern Illinois College of Optometry; Louis Wekstein, D.Sc., Massachusetts School of Optometry; Harold Simmerman, O.D., Pennsylvania State College of Optometry; E. E. Rogers, M.D., Vancouver, British Columbia; and Sidney J. Williams, National Safety Council, Chicago, Illinois.

An interesting and informative symposium on refraction which

emphasized the dynamic cross cylinder test technique, interpretation and application was conducted by Arthur B. Bissaillon, O.D., as moderator with the assistance of J. Donald Kratz, O.D., Lester H. Sugarman, O.D., and Edwin P. Leonard, Jr., O.D., as lecturers.

It is hoped that the papers presented at the convention will be published so that those who could not attend may have the advantage of this worthwhile material and, also, even for those who did attend, so that by further study more benefit may be realized.

Several meetings were held by the International Association of Boards of Examiners in Optometry and it may be noted that some of these meetings were scheduled during most of the time when the educational lectures were being presented. The members of this important association must prepare the State Board examinations in their respective states and it seems unfortunate that they did not have opportunity to hear the educational lectures which might acquaint them with some recent developments in optometry.

The Association of Schools and Colleges of Optometry, the American Optometric Foundation, the Distinguished Service Foundation of Optometry, and various other associations and committees, including the Aniseikonic Forum and the Section on Aniseikonia of the American Academy of Optometry, held their respective meetings during the convention period.

Although the educational lectures were very well attended in comparison with former years, it might be pointed out that a much larger attendance would be expected if the various associations and committees, some of which are concerned with educational matters, were not scheduled concurrently.

Rear-Admiral Joel T. Boone gave a most interesting and entertaining address at the banquet. In the course of his remarks he stated his reluctance to countenance any infringement of the public's freedom of health service by federal legislation. Admiral Boone's account of his war experiences in the Orient was most fascinating and impressive. Furthermore, his assurance that optometrists were needed and welcome in the Navy was very encouraging.

Before the convention closed, the delegates selected Minneapolis, Minnesota, as the 1950 convention city. The dates for the 53rd annual congress will be announced later.

By and large, it was a splendid convention and indications were manifest that optometry has come of age and is fast gaining stature by making steadfast progress toward professionalism and the advancement of knowledge in the field of eye care.

TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy.

NEW MEMBERS OF THE ACADEMY

The following optometrists and educators were elected to Fellowship in the American Academy of Optometry during the quarter ending June 30. The Academy welcomes these new members.

Mr. S. Black, 36 Hart Street, Hanley-on-Thames, Oxon, England.

Dr. William H. Dowdell, 10-12 Phillips Building, Malvern, Arkansas.

Dr. E. J. Fisher, College of Optometry of Ontario, 140 St. George Street, Toronto 5, Ontario, Canada.

Dr. Maurice E. Lemontree, 219 Poledor Building, South Bend, Indiana.

Dr. Alfred Lit, School of Optometry, Columbia University, 433 West 123rd Street, New York 27, New York.

Dr. C. C. Richter, 403 Walnut Street, Lawrenceburg, Indiana.

Dr. William B. Simukka, Northern Illinois College of Optometry, 4170 Drexel Boulevard, Chicago 15, Illinois.

Dr. Ernest S. Takahashi, Chicago College of Optometry, 1849 North Larabee Street, Chicago, Illinois.

Dr. John Edward Wright, Northern Illinois College of Optometry, 4170 Drexel Boulevard, Chicago 15, Illinois.

"THE BIGGEST AND BEST"

December seems a long way off from July, but it's not a bit too soon for Academy members to start making definite plans to attend the annual convention at Cleveland. Each year we boast the convention will be the "biggest and best convention in the history of the Academy," and we haven't been wrong yet, so we can safely predict this year's meeting will equal and surpass (we sometimes wonder how they can get better!) all previous gatherings. Dr. Robert Bannon has lined up more than 30 excellent technical papers for the four-day session; the General Electric Company plans to entertain Academy members at dinner and put on a lighting demonstration, and, as in the past, those interested in special fields will have a chance to attend special sessions on aniseikonia, orthoptics, pathology and contact lenses.

Make your reservations now for accommodations in Cleveland for December 10-13. The address of the Hotel Hollenden, headquarters for the convention, is 610 East Superior Avenue, Cleveland, Ohio. All types of rooms are available; all are equipped with bath or shower. Rates start at $3.50 for single rooms.

CURRENT COMMENTS

Virginia Huck
Editorial Assistant

Optometrists will confer a favor by sending news items of general interest for this department; such as relate to new instruments, clinical techniques, education, visual health and optometric legislation and organization.

A.O.A. REELECTS O'SHEA PRESIDENT

Dr. John B. O'Shea of Northampton, Massachusetts, was re-elected president of the American Optometric Association at the 52nd Annual Congress in Boston on June 29. Also returned to office by convention delegates were the following men: Dr. J. Ottis White, Baton Rouge, Louisiana, vice president; Dr. Joseph M. Babcock, Portsmouth, Ohio, vice president; Dr. James F. Wahl, Anna, Illinois, vice president; Dr. S. L. Brown, Fostoria, Ohio, treasurer; Dr. L. Wayne Brock, Greenville, South Carolina, trustee; Dr. Lawrence H. Foster, San Jose, California, trustee; Dr. Ernest H. Kiekenapp, Minneapolis, Minnesota, secretary, and Mr. Harold Kohn, New York, New York, counsel.

SAN JOSE WORKSHOP SET FOR AUGUST

The annual San Jose visual training workshop will be held August 20, and 21, in the San Jose civic auditorium. The principal speaker will be Dr. Harold Haynes, chairman of the visual training department of Pacific University School of Optometry. Featured this year will be table clinics, each with its own instructor, to insure individual participation and instruction. Those attending will find instruction available on size constancy, accommodative-convergence training, satiety, disparation, pointing, fusion training, saccadic eye movements, stereopsis training, rotations, convergence, accommodative training, digit training, words and phrases, serial reproduction, and Poloroid ring projection, according to the planning committee.

The workshop is sponsored by the Central Coast Optometric Association. Attendance is restricted to members of state and/or national associations and their assistants.

JOURNAL TO BE MICROFILMED

Microfilm editions of the *American Journal of Optometry* will soon be available to subscribers through University Microfilms of Ann Arbor, Michigan. The Journal has completed arrangements for this firm to reproduce future editions of the magazine on microfilm for distribution to subscribers. These editions are being produced primarily for use by libraries which wish to conserve storage space and reduce binding costs. Inquiries about microfilms of the Journal should be addressed either to the Journal office, 1502 Foshay Tower, Minneapolis 2, Minnesota, or to University Microfilms, 313 North First Street, Ann Arbor, Michigan.

OPTOMETRISTS IN THE NEWS

Mr. Maurice Belanger, Ottawa optometrist, was recently chosen by the University of Ottawa to lecture on refractive problems to graduate nurses in the School of Nursing. The lectures are part of the University's efforts to broaden the curriculum of the School of Nursing so that graduates will be better prepared to serve the public. Mr. Bellanger has completed the first series of lectures, and the University has approved a future series.

Iowa members of the Illuminating Engineering Society heard Dr. Carel C. Koch, Editor of the *American Journal of Optometry*, speak at their spring conference June 10. Dr. Koch's topic was "Visual Efficiency and Illumination."

Now Dean of the College of Optometry, Pacific University, is Dr. Richard Feinberg. His appointment was announced by Dr. Edwin T. Ingles, vice president of the University. Since affiliating with Pacific University in the Fall of 1948, Dr. Feinberg has served as professor of optometry and executive secretary of the College of Optometry.

Also moving to the position of Dean is Dr. Lawrence Fitch, who succeeds his father, Dr. Albert Fitch, at the Pennsylvania State College of Optometry, Philadelphia. Dr. Albert Fitch has been elected president by the board of trustees.

SUMMER GRADUATE COURSE OFFERED BY L. A. COLLEGE

The Los Angeles College of Optometry is offering a summer graduate course for practicing optometrists starting August 1. The course will run to September 9. Optometrists may enroll for credit, or audit the courses. Application blanks are available upon request to the Los Angeles College of Optometry, 950 West Jefferson Boulevard, Los Angeles 7, California.

A. O. COMPANY GRAPH ON DRIVERS' LICENSE AVAILABLE

For a quick, comprehensive review of the requirements for motor vehicle operators in the United States, we recommend American Optical Company's recently published graph showing results of their latest survey. On one sheet (folded), is shown findings as of March, 1949, on the necessary qualifications for obtaining drivers licenses in all states, including visual acuity required. A. O. Company will furnish copies upon request as long as their supply lasts. Write the Professional Relations Department, Southbridge, Massachusetts.

NEWS BRIEFS

Five buildings have been acquired by the Chicago College of Optometry for use as dormitories and a clinic. The new campus now covers a square block in the center of Chicago's gold coast district. The newly-acquired buildings were once part of the estate of an Illinois senator, and until taken over by the Chicago College of Optometry, were used by Northwestern University. Two of the buildings were put into use as dormitories June 6 for summer session students. The remaining three are being equipped for the clinic. School officials expect to open the clinic September 1. . . . Secretary of the Titmus Optical Company, E. Hutson Titmus, recently devoted three months to the raising of funds for the new Petersburg, Virginia, hospital. Under Mr. Titmus' leadership, campaign workers raised more than a million dollars for the proposed 215-bed community hospital. . . . A weekly news letter for optometrists is now on the market. The new publication which has a format similar to the Kiplinger news letter, plans to report facts, trends, and topics of interest to the practicing optometrists. Dr. Irving Filderman of Memphis, Tennessee, is the editor. . . . American Optical Company announces two new developments: a new colored barium glass for use in absorptive lens bifocal segments designed to provide greater protection from the sun, and a new occluder lens claimed to be cosmetically more attractive and functionally more efficient than previous lenses.

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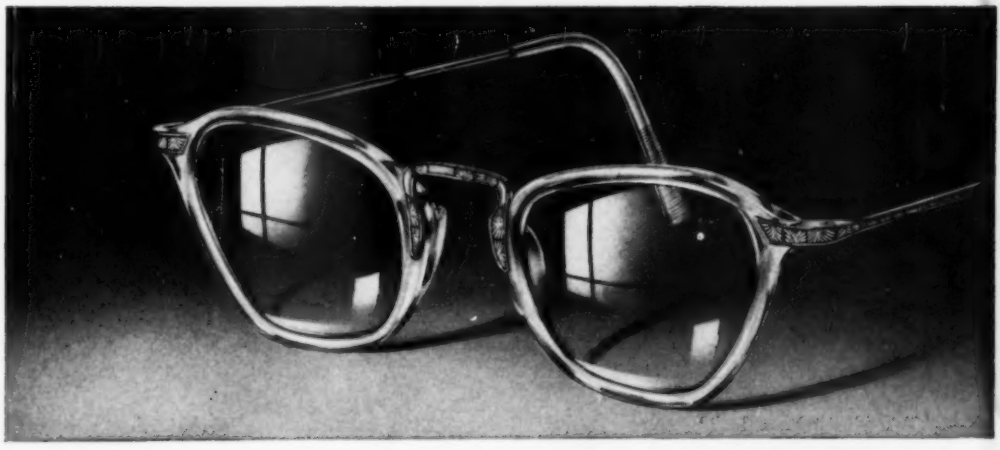
how to help
a puzzled patient
make up her mind



Pestered by a patient who can't make up her mind?
Slip her face into a Lady Dean and watch the puzzled expression change into one of decision. Lady Dean's smart, upsweep styling; its distinctive combination of zyl and 1/10th of 12K gold filled bridge and temples; its famous "I never know I have them on" comfort make Lady Dean the choice of discriminating women everywhere. But why waste time—Just show her the Lady Dean first and avoid puzzled patients. Available in Pink Pearl, Blue Pearl, Rosetint and Demi-Blonde. Your supply house will be glad to show you samples!

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The Bio-photometer provides a fundamental visual test in connection with the ability of your patients to respond to light and darkness. Light thresholds are measured over an extremely wide range. A standard source of bright light is included so that a standardized test for dark adaptation can be made. You can detect even mild degrees of "night blindness" with the Bio-photometer. World-wide use since 1936. Fairly prompt deliveries for the first time in several years. Write for complete information.

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The Linda—your answer to the ladies and the modern look, plus good optical design and adjustability. Eye arms are factory pre-formed. There are 4 lens shapes, all having a pleasing tilt. The bridge swings up. Engraving is deep cut and sparkling.

We stock the Linda regularly and recommend it every time we get a chance. It does a professional optical job, beautifully.

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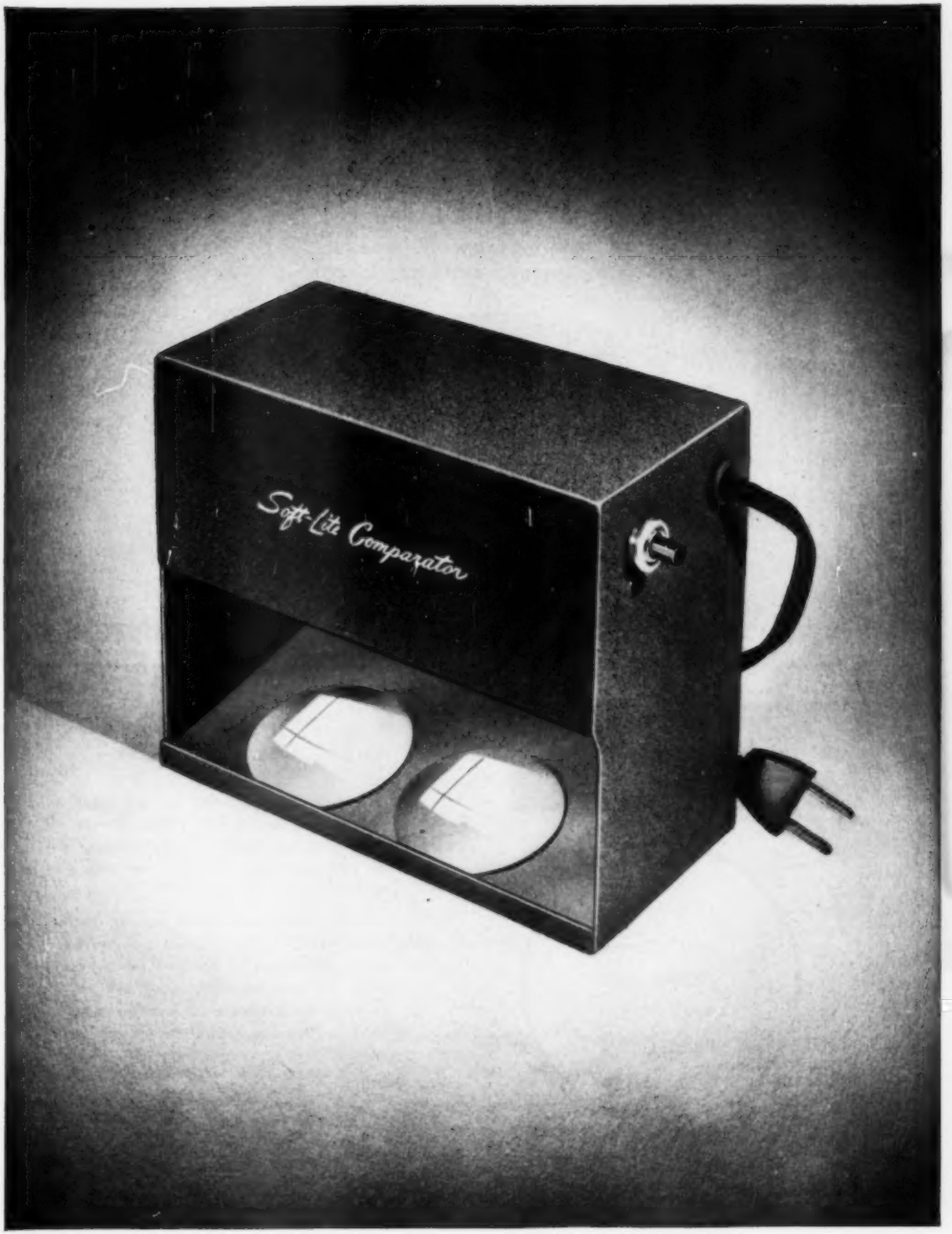

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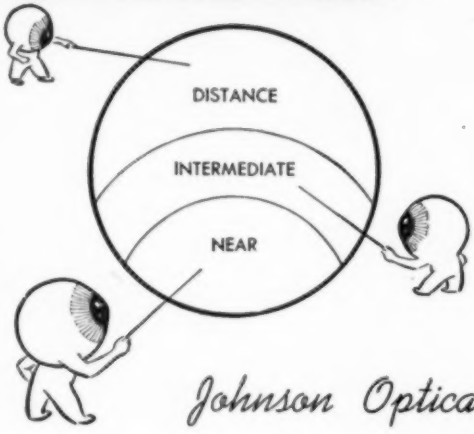

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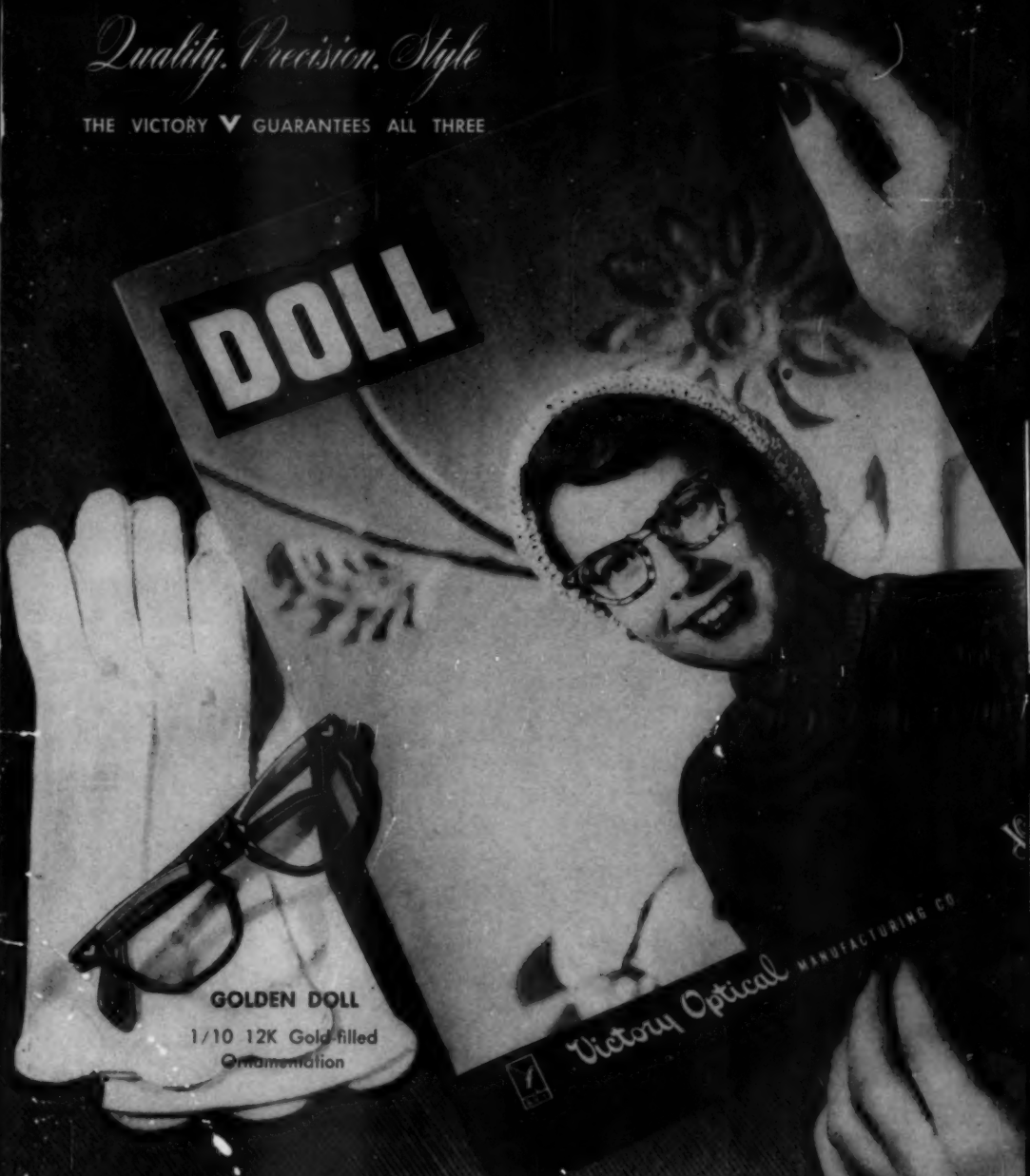

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